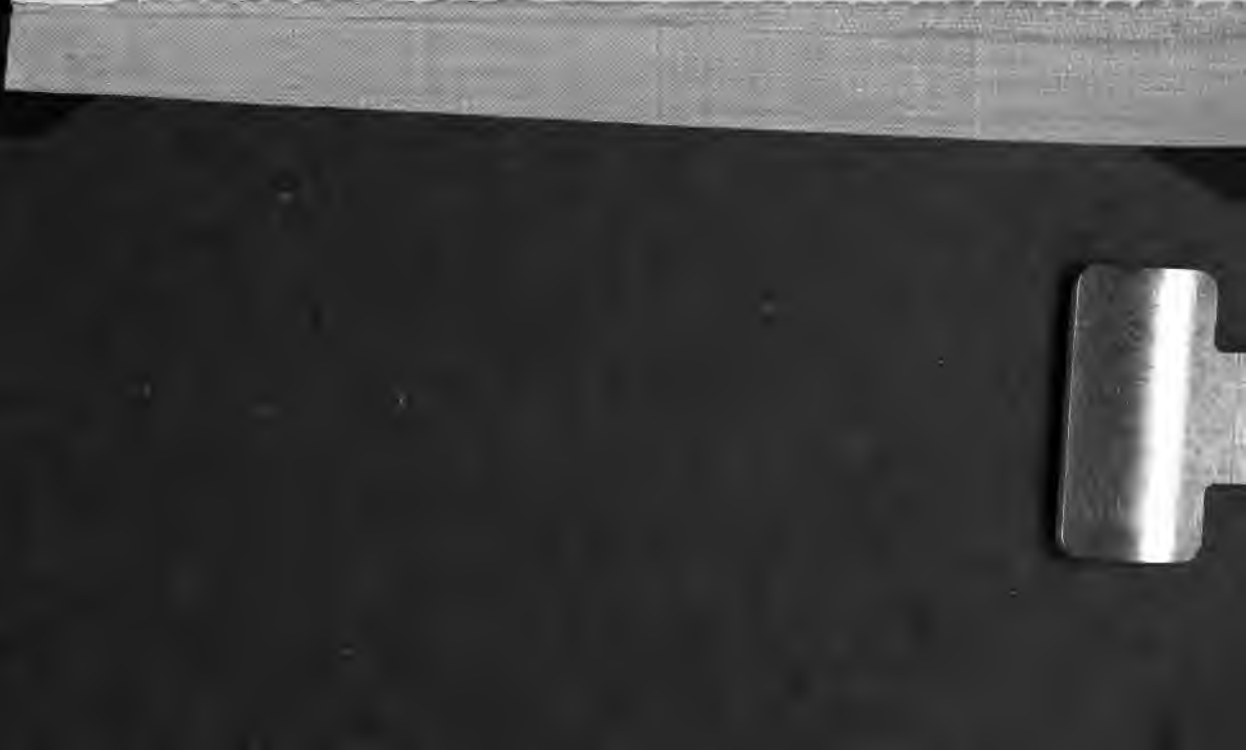


STANDARD STEEL CONSTRUCTION

A MANUAL FOR

ARCHITECTS ENGINEERS AND CONTRACTORS

Containing Useful Tables, Formulas and other Information.

Beams, Channels and Structural Shapes,

MADE BY

AMERICAN IRON & STEEL WORKS

JONES & LAUGHLINS, LIMITED

PITTSBURGH, PA. CHICAGO, ILL.

REVISED BY D. N. BARKER.

PRICE, $1.00.

1896.

ROGERS & SMITH CO., Printers,
148-150 Monroe St., Chicago.

PREFACE.

In submitting the following tables of properties of Steel Beams, Channels and other structural material, with tables of strength, etc., we call attention to the fact that they are computed from recent tests and experiments. Although Steel for general construction has been only recently introduced, yet so rapid has been its adoption that all architects and engineers who have kept pace with the time appreciate its advantages and adopt it for all work of any magnitude in preference to wrought and cast iron. The advantages are greater strength and less weight, the material can be made to required specifications and can be inspected at all stages of its manufacture.

We have discontinued making Iron Beams and Channels. We regard our sections of Steel Beams, Channels, Angles, etc., as the most desirable, being the result of our experience. Some of them are lighter sections than made by other mills. We call attention to diagrams showing details.

We are manufacturing Steel Columns of various kinds, notably the "Larimer Column," which is one of the best now on the market. It has proved by tests made and comparison with other Columns to be superior in strength, simplicity in construction, method of connecting, etc.

Preface to Second Edition.

In this second edition of STANDARD STEEL CONSTRUCTION, we present standard sections of Steel Beams, Channels and Angles, as adopted by the American Association of Steel Manufacturers, January, 1896, and new tables of properties and safe loads; also standard sizes and weights of Larimer Columns, with tables of properties and safe loads.

We also present diagrams of 20 inch Beams, and properties and safe loads of 20 and 24 inch Beams; also diagrams of additional shapes and standard details of roof trusses. We have adopted a different method of numbering our shapes, and call attention to the new system as shown herein. We have added to our steel production an open-hearth basic steel plant of large capacity, and can supply these shapes in Open-Hearth Steel to standard specifications. So satisfactory has been our product of Soft Bessemer and Open-Hearth Steel that we have discontinued the manufacture of our brands of refined iron, and have substituted in all our work our special grades of steel. Our customers, who have used the steel in large quantities, are thoroughly satisfied with the results.

JONES & LAUGHLINS, LIMITED.

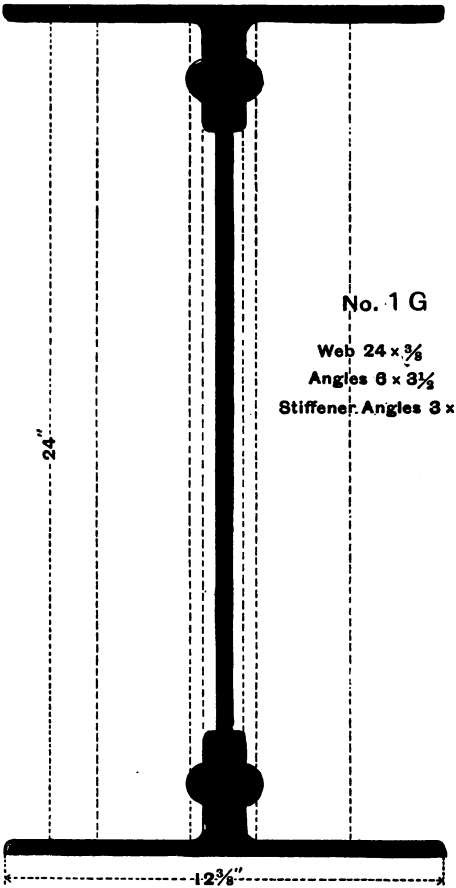
CHICAGO, July, 1896.

DIAGRAMS OF SHAPES

MANUFACTURED BY

JONES & LAUGHLINS, LIMITED.

PLATE GIRDER.
STEEL.

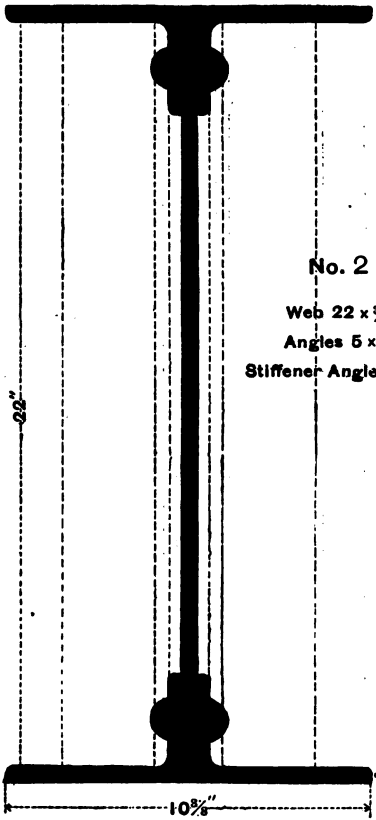


No. 1 G

Web 24 x ⅜
Angles 6 x 3½
Stiffener Angles 3 x 2½

For table giving safe loads see pages 104 and 105.

PLATE GIRDER.
STEEL.



No. 2 G

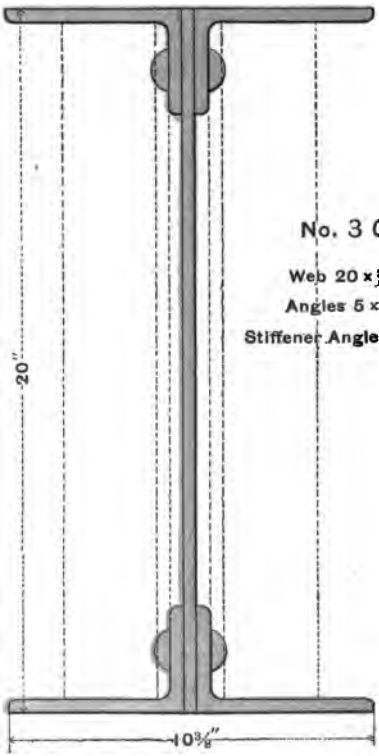
Web 22 × ⅜

Angles 5 × 3

Stiffener Angles 3 × 2½

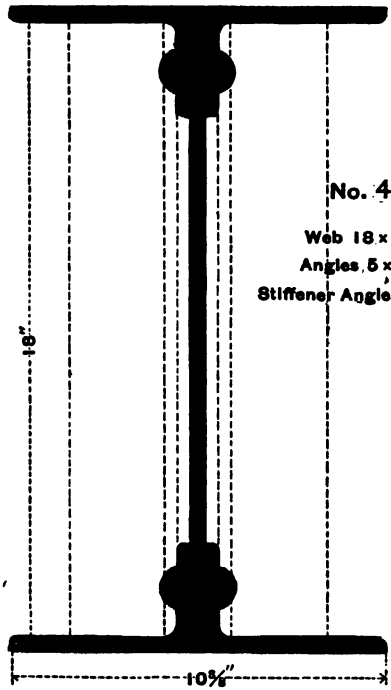
For table giving safe loads see pages 105 and 106.

PLATE GIRDER.
STEEL.



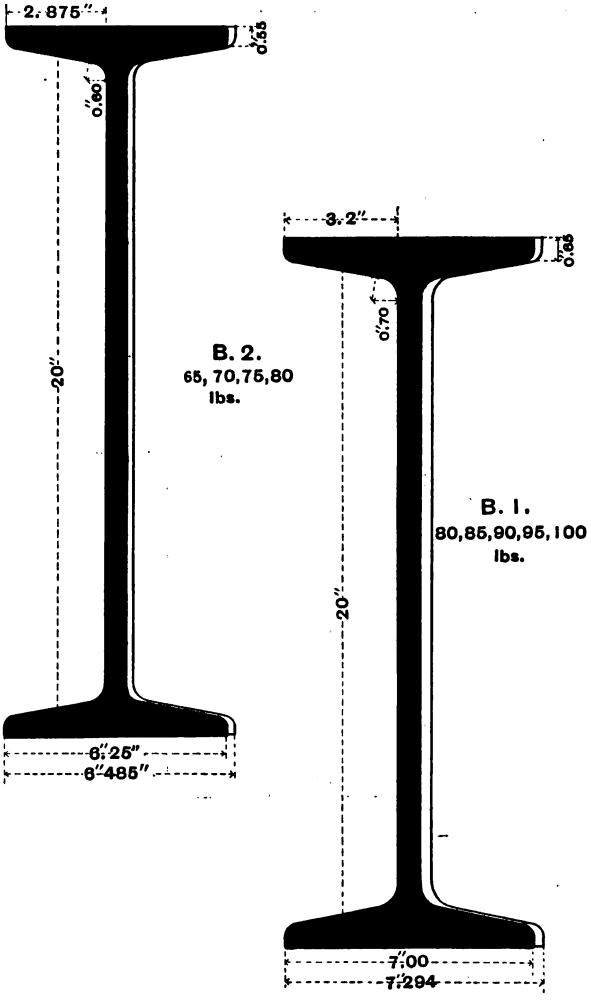
For tables giving safe loads see pages 107 and 108.

PLATE GIRDERS.
STEEL.



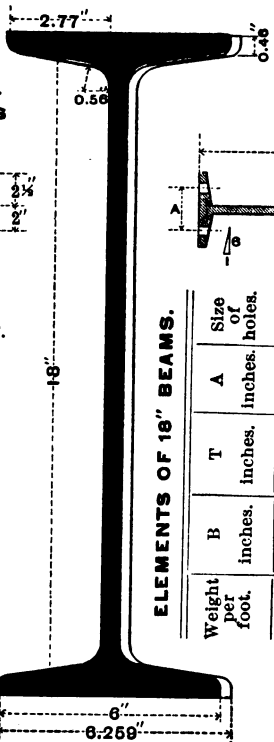
For table giving safe loads see pages 108 and 109.

STANDARD SECTIONS.
STEEL BEAMS.

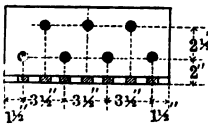


STANDARD SECTIONS.
STEEL BEAMS.

B. 2½
55, 60, 65 & 70 lbs.

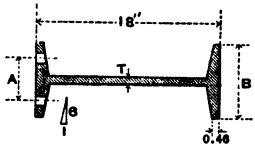


STANDARD CONNECTION ANGLES FOR 18" BEAMS.



$\frac{13}{16}$" holes.

2-6" x 6" x $\frac{7}{16}$"-L-1' 1½".



ELEMENTS OF 18" BEAMS.

Weight per foot.	B inches.	T inches.	A inches.	Size of holes.
55	6.000	0.460	3¼	13/16"
60	6.095	0.555	3¼	13/16"
65	6.177	0.637	3¼	13/16"
70	6.259	0.719	3¼	13/16"

See next page for Properties and Safe Loads.

PROPERTIES OF JONES & LAUGHLINS, LIMITED, 18" BEAMS.

1	2	3	4	5	6	7	8	9	10	11	12	13
Section.	Depth of Beam.	Width per Foot.	Area of Section.	Thickness of Web.	Width of Flange.	Moment of Inertia, Neutral Axis perpendicular to Web at center.	Section Factor, Neutral Axis as before.	Radius of Gyration, Neutral Axis as before.	Coefficient of Strength for Fiber Strain of 16,000 Lbs. per Sq. In. Used for Buildings.	Coefficient of Strength of Fiber Strain of 12,500 Lbs. per Sq. In. Used for Bridges.	Moment of Inertia, Neutral Axis Coincident with Center Line of Web.	Radius of Gyration, Neutral Axis as before.
No.	Inches.	Lbs.	Sq. In.	Inches.	Inches.	I	R	r	C.	C′	I′	r′
B 2½	18	55	15.93	0.460	6.000	794.15	88.24	7.06	941,224	735,336	21.19	1.150
" "	18	60	17.65	0.555	6.095	840.32	93.37	6.90	995,944	778,080	22.38	1.126
" "	18	65	19.12	0.637	6.177	880.17	97.80	6.78	1,043,200	815,000	23.47	1.110
" "	18	70	20.59	0.719	6.259	920.02	102.22	6.68	1,090,344	851,832	24.68	1.094

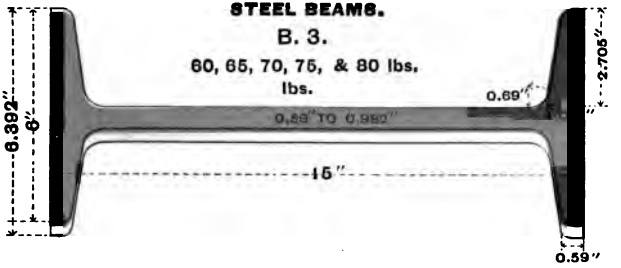
SAFE LOADS, UNIFORMLY DISTRIBUTED FOR JONES & LAUGHLINS, LTD., 18" BEAMS, IN TONS OF 2,000 LBS.

Distance Between Supports In Feet.	55 Lbs.	60 Lbs.	65 Lbs.	70 Lbs.	Distance Between Supports In Feet.	55 Lbs.	60 Lbs.	65 Lbs.	70 Lbs.	Distance Between Supports In Feet.	55 Lbs.	60 Lbs.	65 Lbs.	70 Lbs.
10	47.06	49.80	52.16	54.52	17	27.63	29.29	30.68	32.07	24	19.61	20.75	21.73	22.71
11	42.78	45.27	47.42	49.56	18	26.14	27.66	28.98	30.29	25	18.82	19.92	20.86	21.81
12	39.22	41.50	43.47	45.43	19	24.77	26.21	27.46	28.70	26	18.10	19.15	20.06	20.97
13	36.20	38.30	40.12	41.94	20	23.53	24.90	26.08	27.26	27	17.43	18.44	19.32	20.19
14	33.62	35.57	37.26	38.94	21	22.41	23.71	24.84	25.97	28	16.81	17.78	18.63	19.47
15	31 38	33.20	34.77	36.34	22	21.39	22.63	23.71	24.78	29	16.23	17.17	17.99	18.80
16	29.42	31.12	32.60	34.07	23	20.46	21.65	22.68	23.70	30	15.69	16.60	17.39	18.17

STANDARD SECTIONS.
STEEL BEAMS.

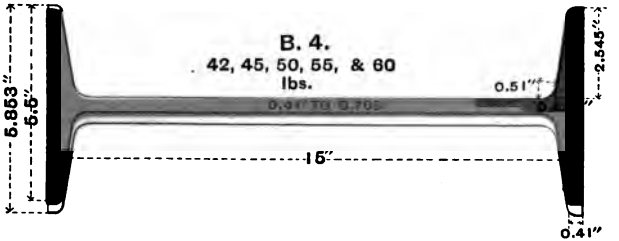
B. 3.

60, 65, 70, 75, & 80 lbs.
lbs.



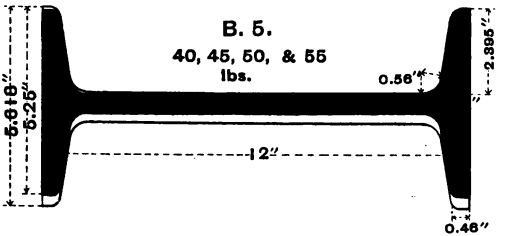
B. 4.

42, 45, 50, 55, & 60
lbs.



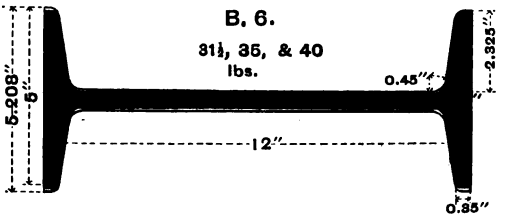
B. 5.

40, 45, 50, & 55
lbs.

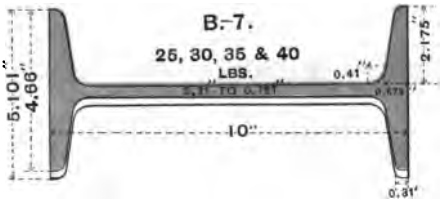


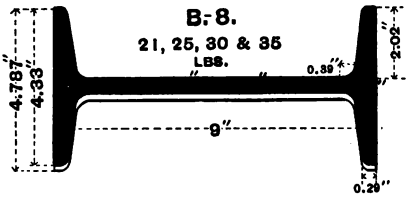
B. 6.

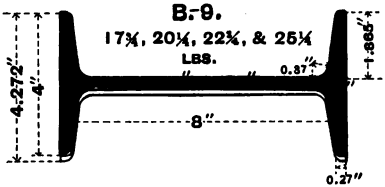
31½, 35, & 40
lbs.

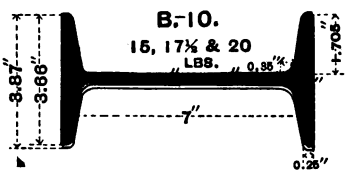


STANDARD SECTIONS.
STEEL BEAMS.





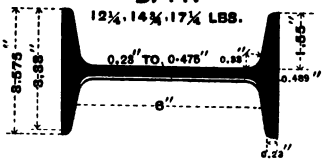




STANDARD SECTIONS.
STEEL BEAMS.

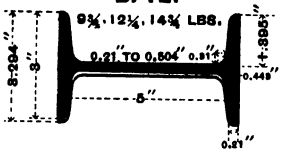
B.-11.

12¼, 14¾, 17¼ LBS.



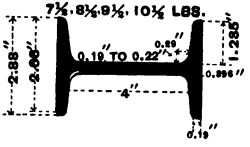
B.-12.

9¾, 12½, 14¾ LBS.



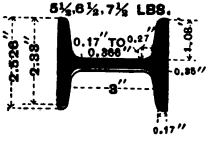
B.-13.

7¼, 8¼, 9½, 10½ LBS.

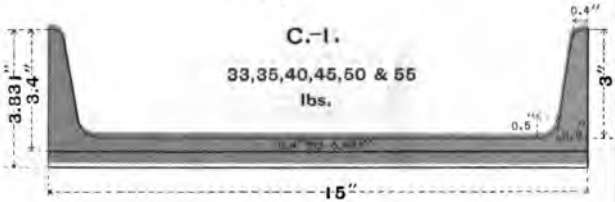


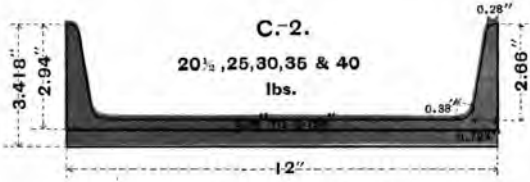
B.-14.

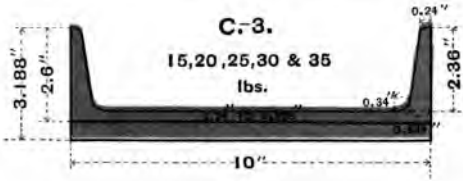
5½, 6½, 7½ LBS.

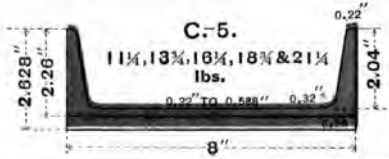


STANDARD SECTIONS.
STEEL CHANNELS.



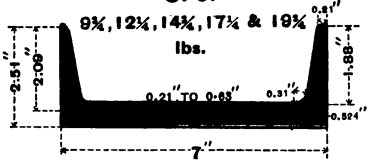




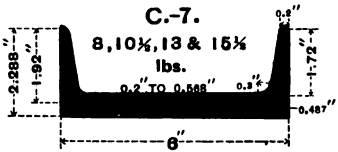


STANDARD SECTIONS.
STEEL CHANNELS.

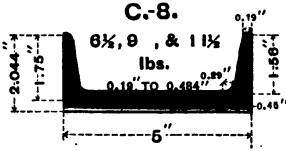
C.-6.



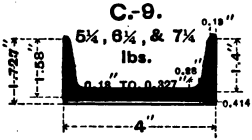
C.-7.



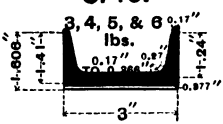
C.-8.



C.-9.

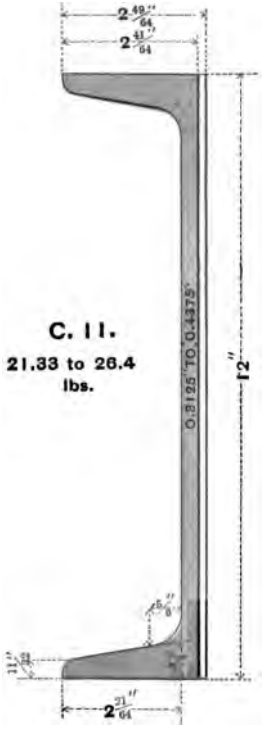


C.-10.



STEEL.

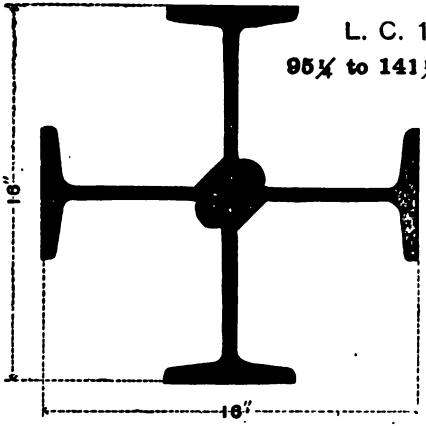
CAR TRUCK CHANNEL.



C. 11.

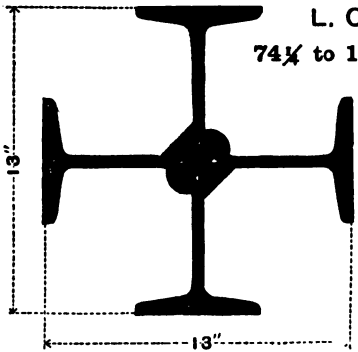
21.33 to 26.4 lbs.

LARIMER COLUMN. STEEL.



L. C. 1

95¼ to 141¼ lbs.

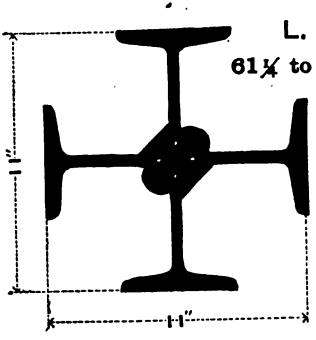


L. C. 2

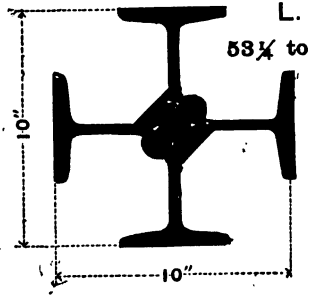
74¼ to 101¼ lbs.

See pages 114 and 115 for safe loads.

LARIMER COLUMNS.
STEEL.



L. C. 3
61¼ to 71¼ lbs.

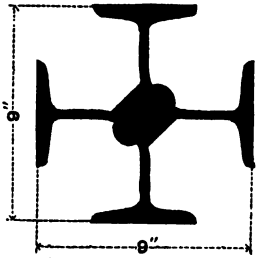


L. C. 4
53¼ to 61¼ lbs.

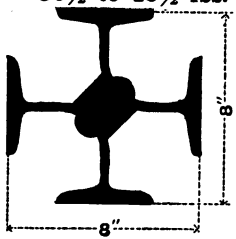
See page 116 for safe loads.

LARIMER COLUMNS.
STEEL.

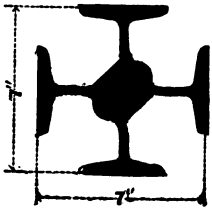
L. C. 5
42 to 52 lbs.



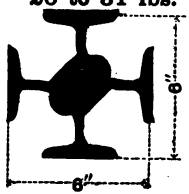
L. C. 6
36½ to 46½ lbs.



L. C. 7
31 to 36 lbs.



L. C. 8
26 to 31 lbs.



See pages 117 and 118 for safe loads.

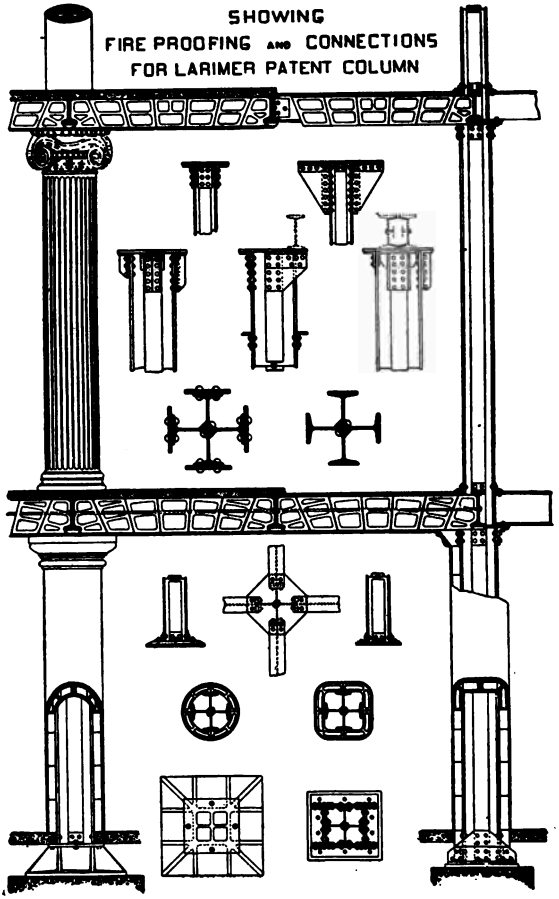
JONES AND LAUGHLINS, LIMITED.
PITTSBURGH — CHICAGO.

STEEL CONSTRUCTION

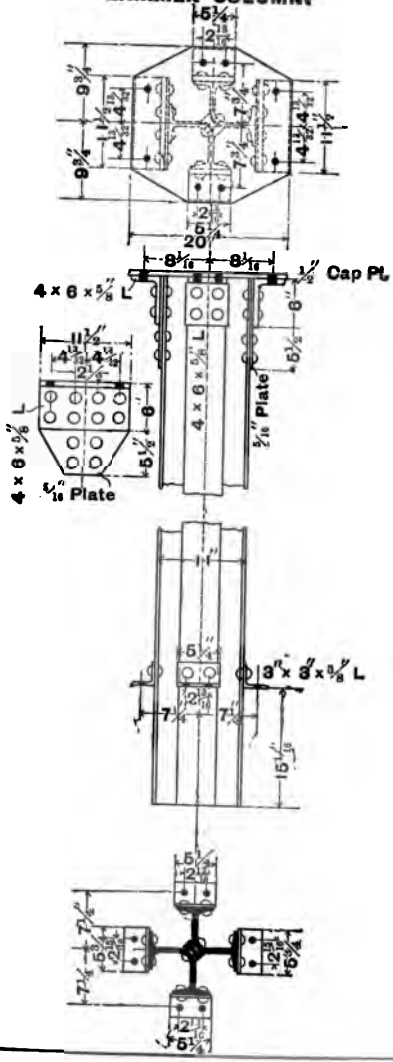
SHOWING

FIRE PROOFING AND CONNECTIONS

FOR LARIMER PATENT COLUMN



LARIMER COLUMN.

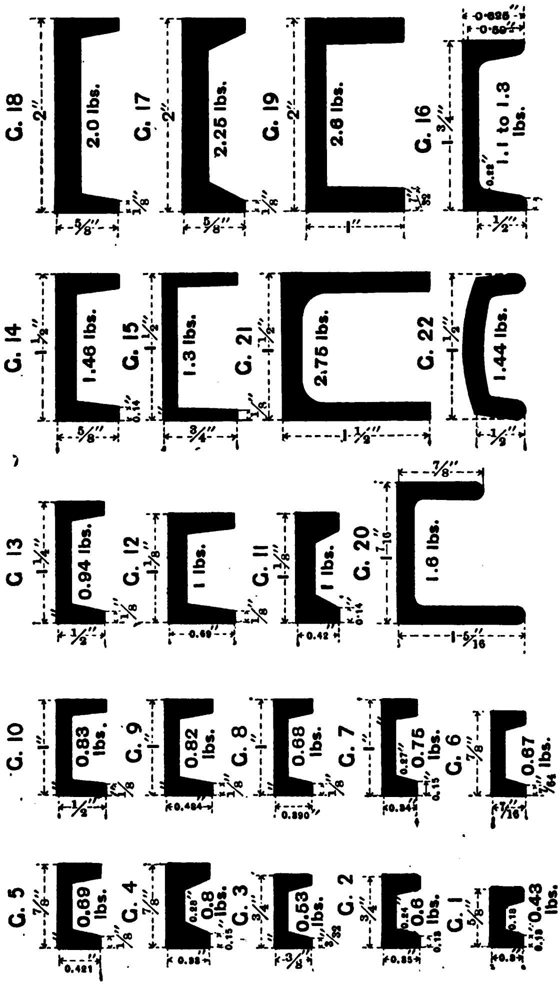


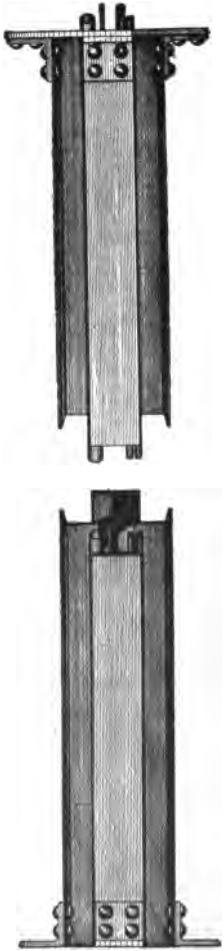
LARIMER COLUMN

SHOWING METHOD OF CONCEALING

PIPES, WIRES, ETC.

GROOVED STEEL.

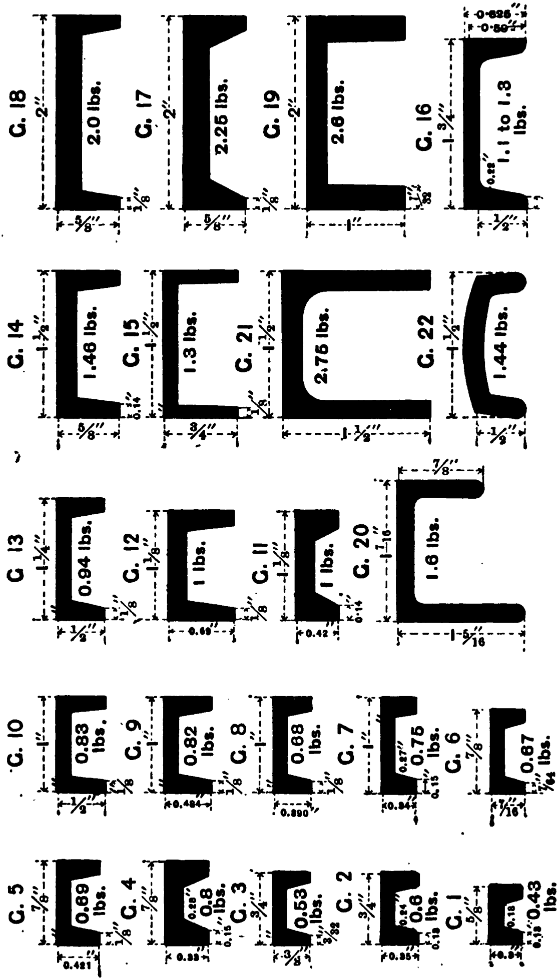




LARIMER COLUMN

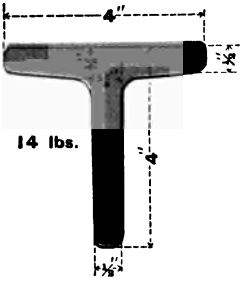
SHOWING METHOD OF CONCEALING PIPES, WIRES, ETC.

GROOVED STEEL.

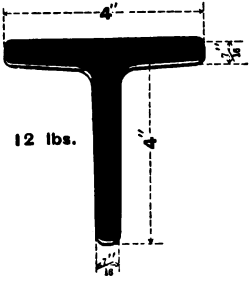


EQUAL LEGGED TEES.
STEEL.

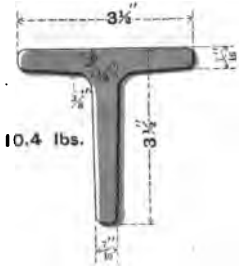
T. 1.



T. 2.



T. 3.



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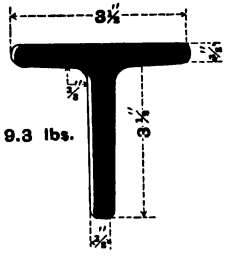

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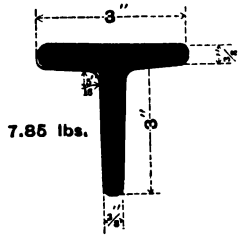

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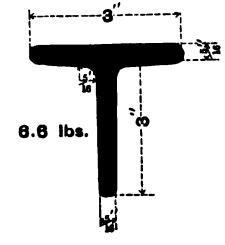
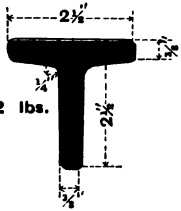


EQUAL LEGGED TEES.

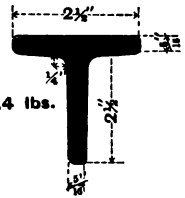
STEEL.

T. 7.



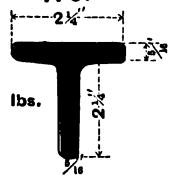
6.32 lbs.

T. 8.



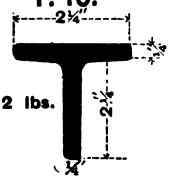
5.4 lbs.

T. 9.



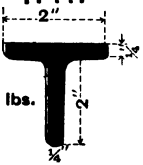
4.62 lbs.

T. 10.



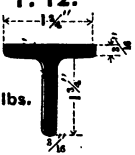
4.12 lbs.

T. 11.



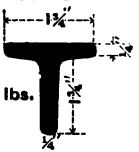
3.5 lbs.

T. 12.



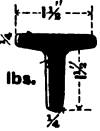
2.33 lbs.

T. 13.



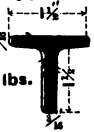
3.0 lbs.

T. 14.



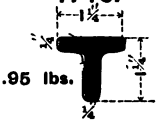
2.62 lbs.

T. 15.



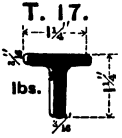
1.9 lbs.

T. 16.



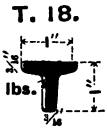
1.95 lbs.

T. 17.



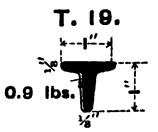
1.55 lbs.

T. 18.



1.25 lbs.

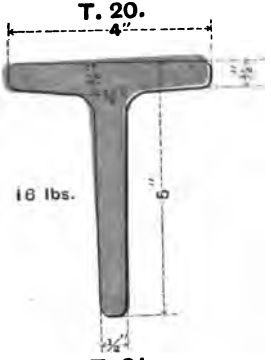
T. 19.



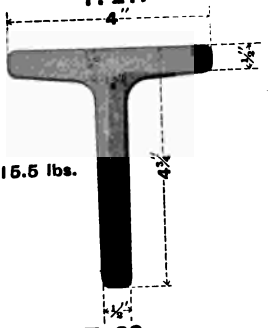
0.9 lbs.

UNEQUAL LEGGED TEES.
STEEL.

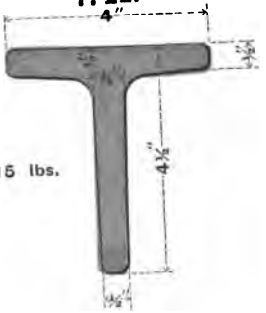
T. 20.



T. 21.

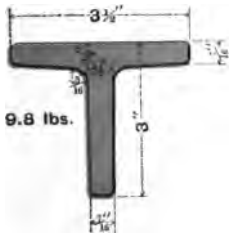


T. 22.



UNEQUAL LEGGED TEES.
STEEL.

T. 23.



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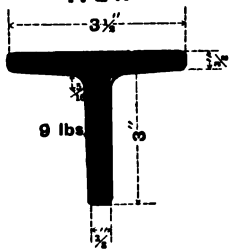
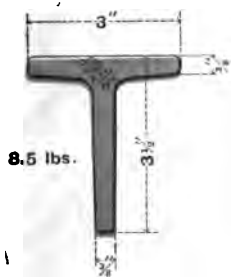


T. 25.



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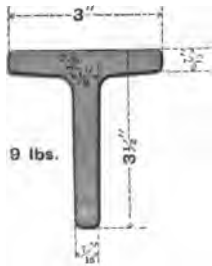

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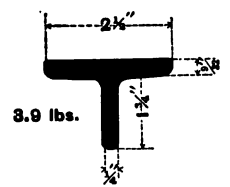

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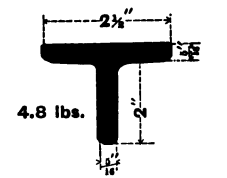
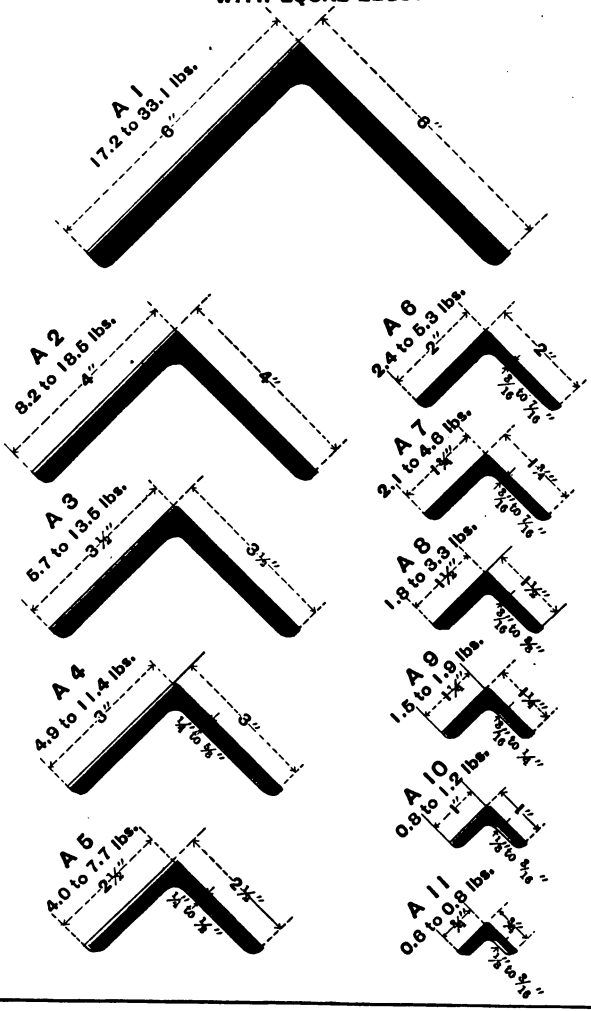
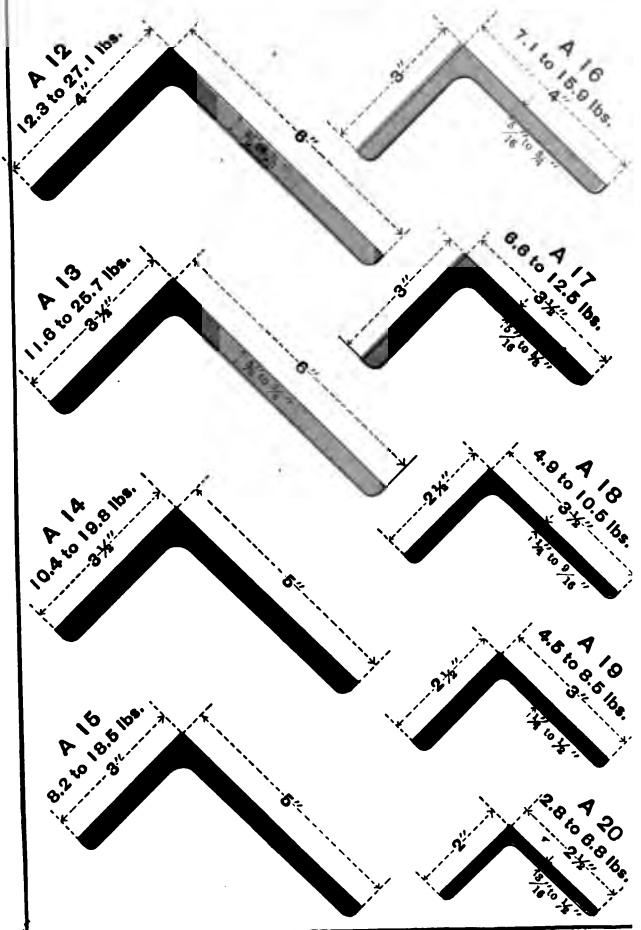


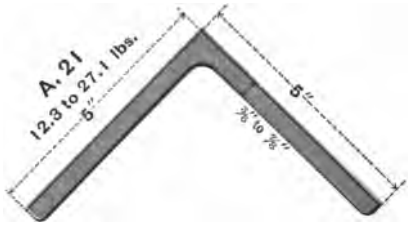
STANDARD SECTIONS STEEL ANGLES WITH EQUAL LEGS.

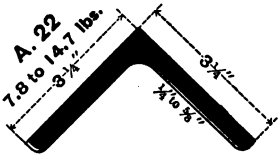


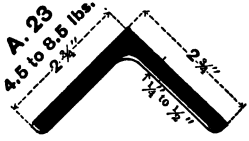
STANDARD SECTIONS
STEEL ANGLES
WITH UNEQUAL LEGS

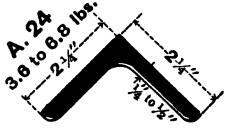


SPECIAL SECTIONS OF ANGLES
MADE TO ORDER
EQUAL LEGS
STEEL.

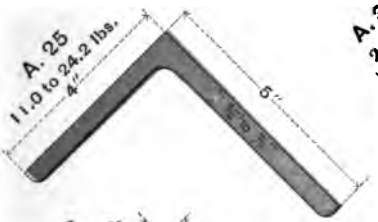


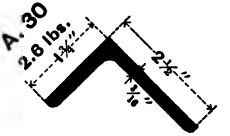


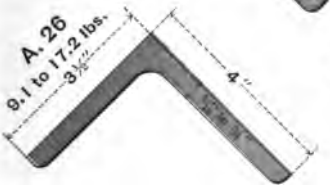


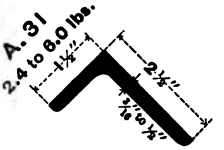


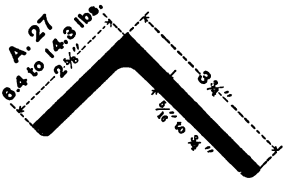
SPECIAL SECTIONS OF ANGLES MADE TO ORDER UNEQUAL LEGS STEEL.

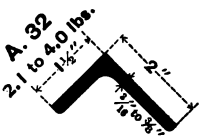


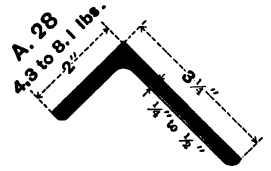


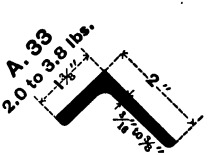


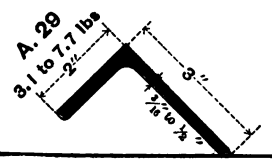








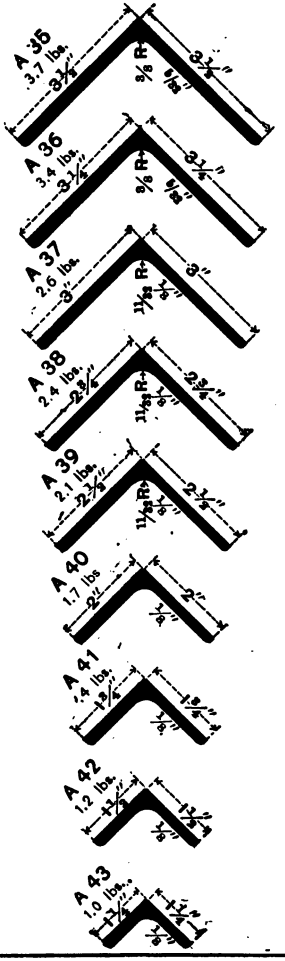




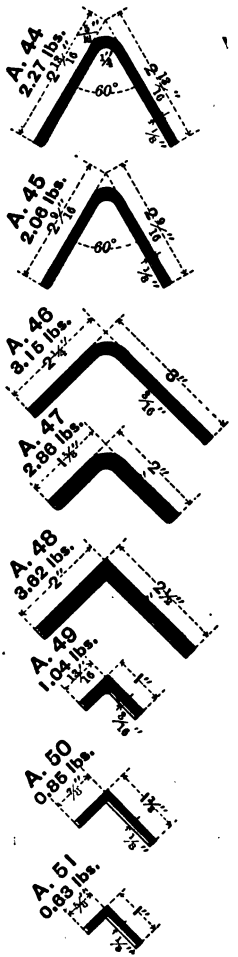
EQUAL LEGGED ANGLES.

Special light sections

STEEL.



SPECIAL SECTIONS OF ANGLES MADE TO ORDER STEEL.

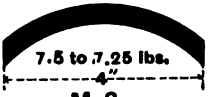


MISCELLANEOUS SHAPES.

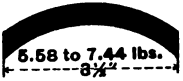
STEEL.

CURVED SLED SHOE.

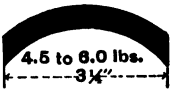
M. 1



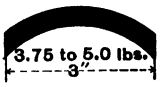
M. 2



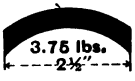
M. 3



M. 4

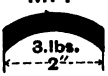


M. 5

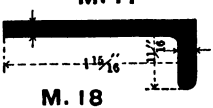


M. 6

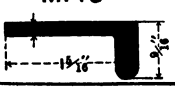
M. 7



M. 17



M. 18

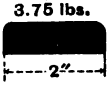


CYLINDER

M. 19
3.75 lbs.

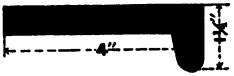
M. 20
3.5 lbs.

M. 21
3.75 lbs.

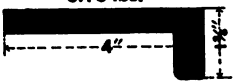


DROPPER BAR.

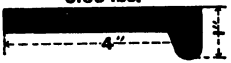
M. 8
7.0 lbs.



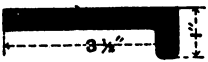
M. 9
6.75 lbs.



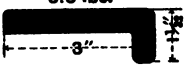
M. 10
6.63 lbs.



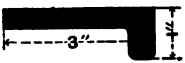
M. 11



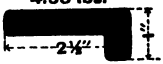
M. 12
5.5 lbs.



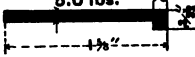
M. 13



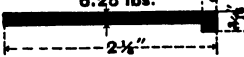
M. 14
4.58 lbs.



M. 15
5.0 lbs.



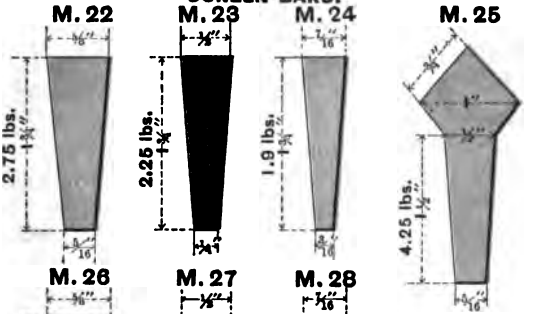
M. 16
6.25 lbs.



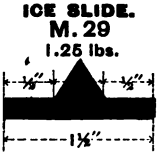
MISCELLANEOUS SHAPES.

STEEL.

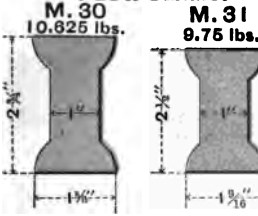
SCREEN BARS.

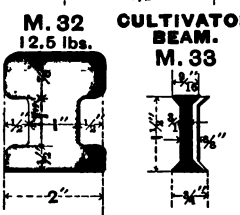


ICE SLIDE.

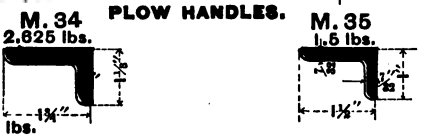


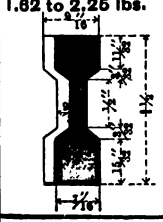
PLOW BEAMS.

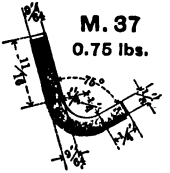


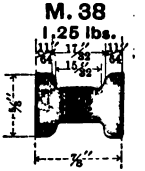


PLOW HANDLES.

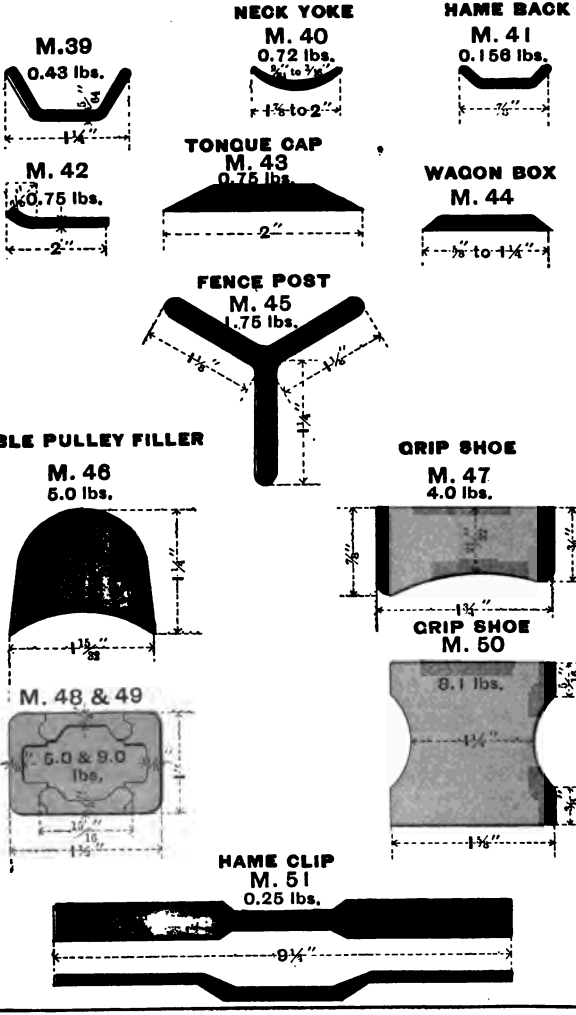




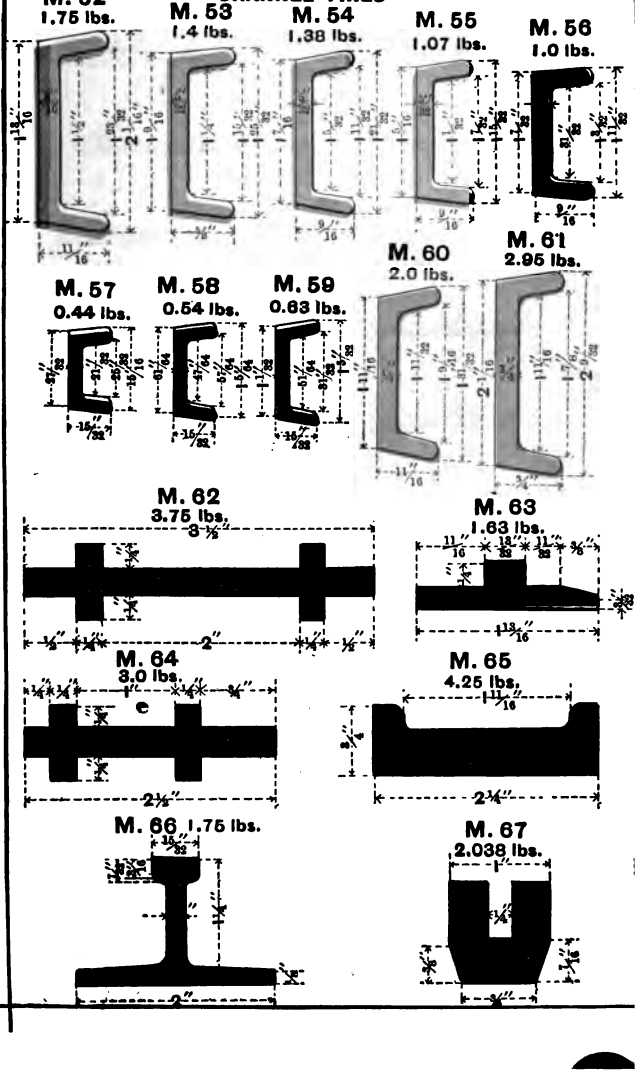




MISCELLANEOUS SHAPES STEEL.

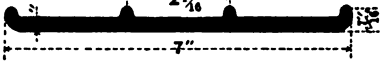


MISCELLANEOUS SHAPES
STEEL.
CHANNEL TIRES

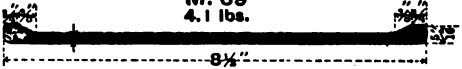


HARVESTER TIRES
STEEL.

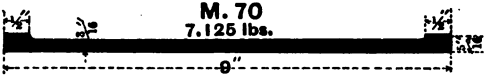
M. 68
5.125 lbs.



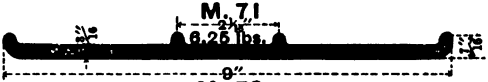
M. 69
4.1 lbs.



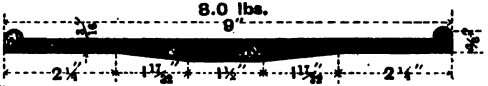
M. 70
7.125 lbs.



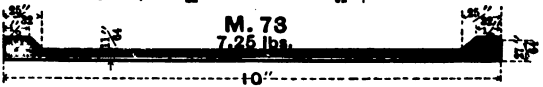
M. 71
6.25 lbs.



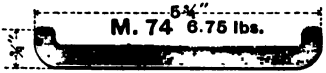
M. 72
8.0 lbs.



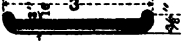
M. 73
7.25 lbs.



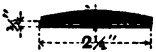
M. 74 6.75 lbs.



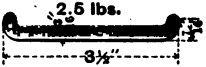
M. 75 2.0 lbs.



M. 76
1.67 lbs.



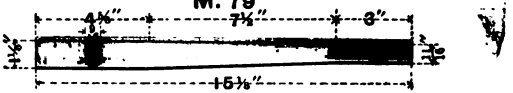
M. 77
2.5 lbs.



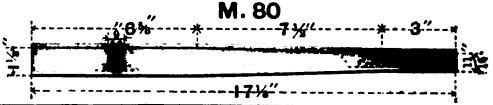
M. 78 1.96 lbs.

HARVESTER SPOKES
STEEL.

M. 79



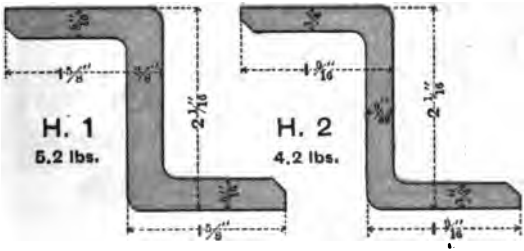
M. 80

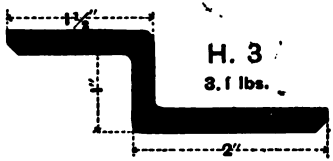


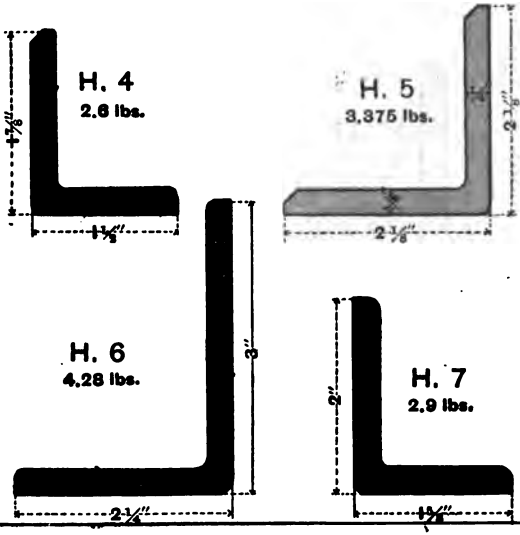
COLD ROLLED.

REAPER and HARVESTER FINGER BARS.

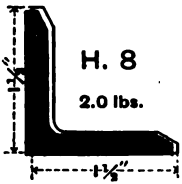
ACCURATELY FINISHED and STRAIGHTENED.

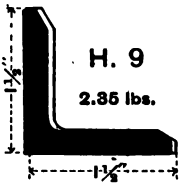


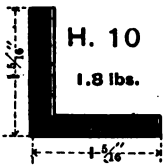


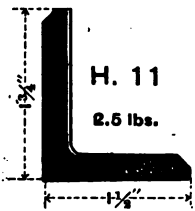


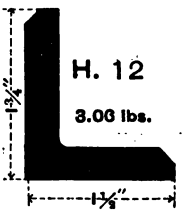
COLD ROLLED.
REAPER and HARVESTER FINGER BARS.
ACCURATELY FINISHED and STRAIGHTENED.

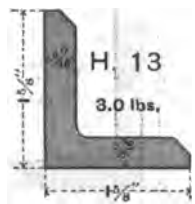


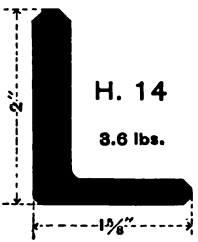






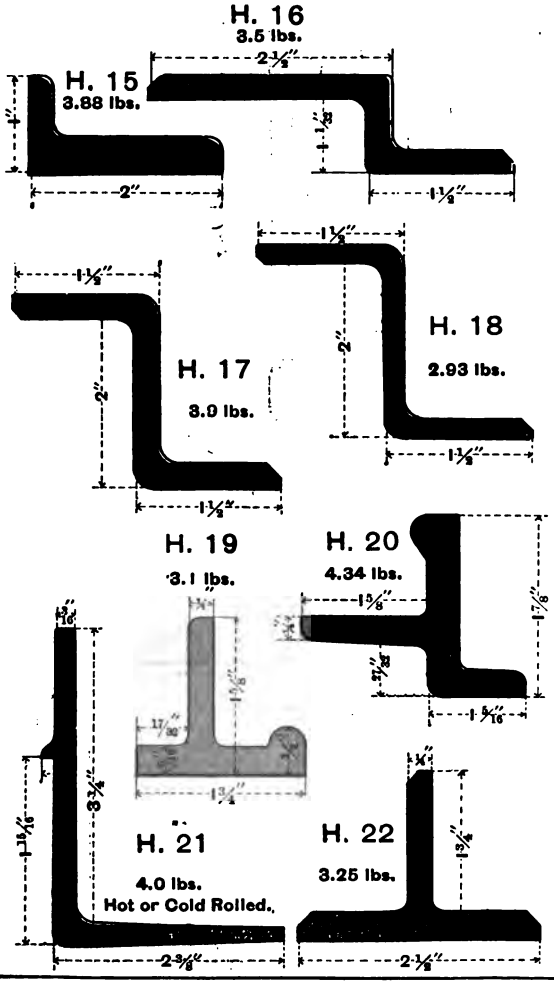




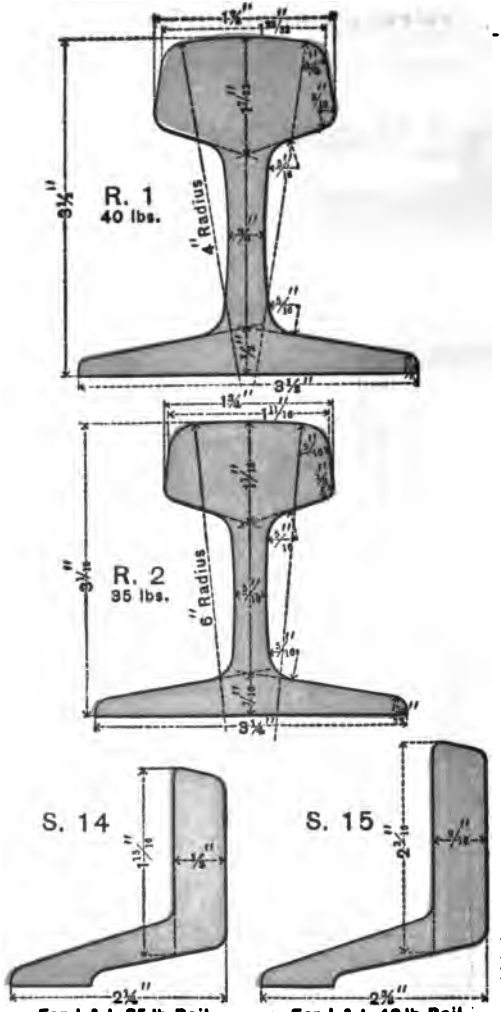


HOT ROLLED.

REAPER and HARVESTER FINGER BARS.



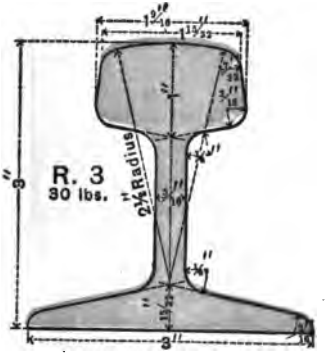
STEEL T RAILS.

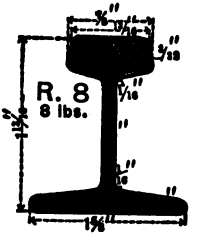


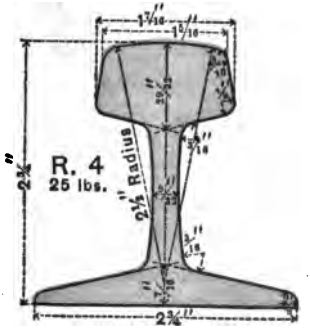
For J. & L. 35 lb. Rail

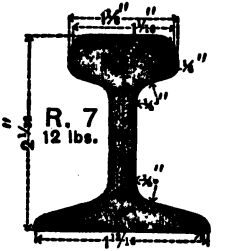
For J. & L. 40 lb. Rail

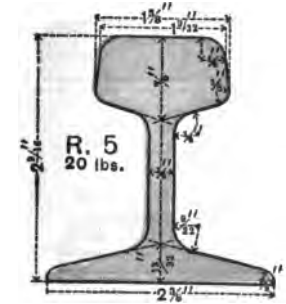
STEEL T RAILS.

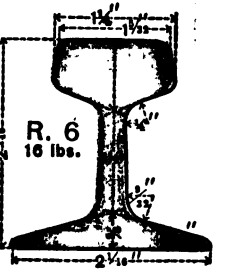




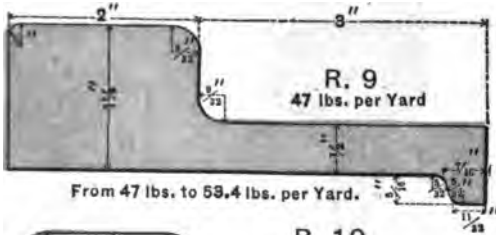




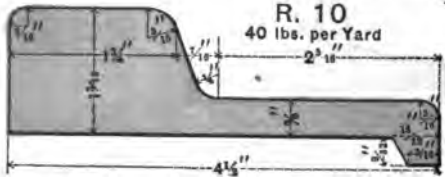




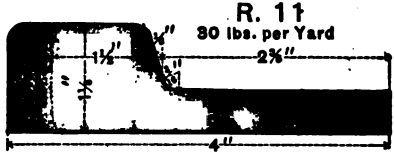
STEEL STREET RAILS.



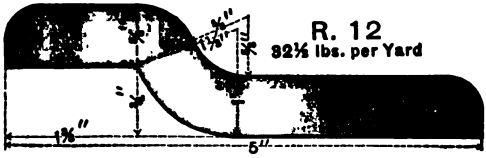
From 47 lbs. to 53.4 lbs. per Yard.



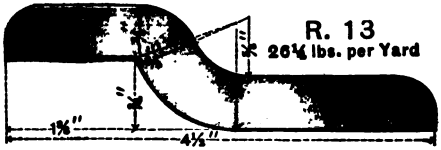
From 37 lbs. to 45½ lbs. per Yard.



From 27 lbs. to 35 lbs. per Yard.



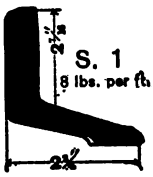
From 25.4 lbs. to 38 lbs. per Yard.

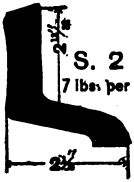


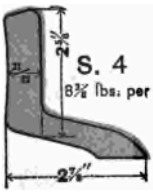
From 24½ lbs. to 35 lbs. per Yard.

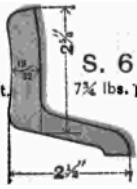
ANGLE SPLICES.

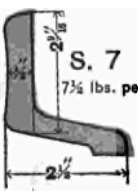
STEEL OR IRON.

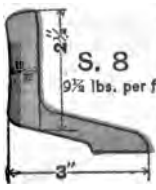


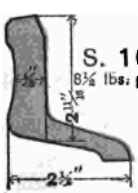


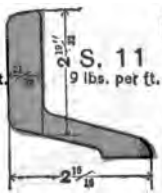


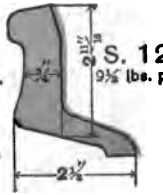




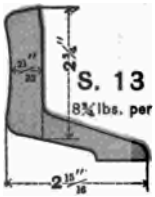


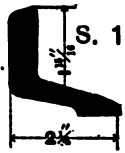


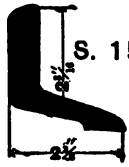


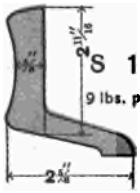


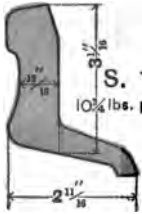
ANGLE SPLICES.
STEEL OR IRON.

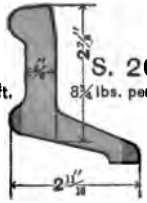


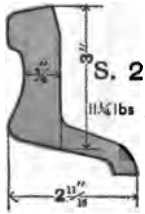


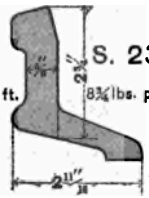


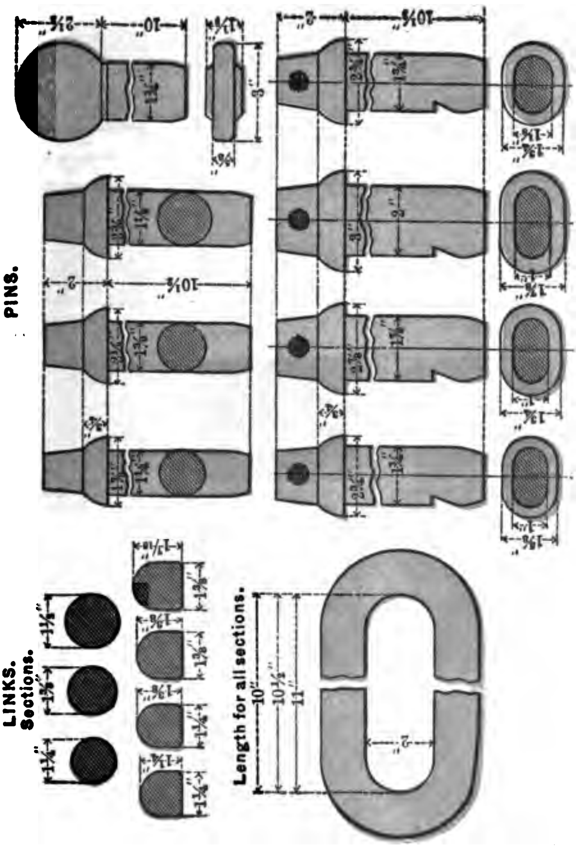








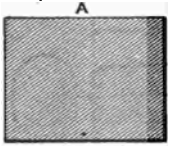



PINS.
LINKS.
Sections.
Length for all sections.
10"
10½"
11"

SYMBOLICAL SHADING AND COLORS.

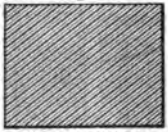
For Cross Sections of Different Materials.

A



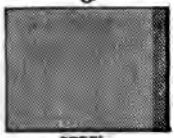
CAST-IRON
Dark India Ink.

B



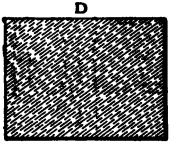
WROUGHT-IRON
Indigo.

C



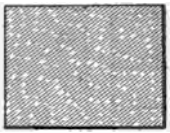
STEEL
Prussian Blue.

D



COPPER
Indian Red.

E

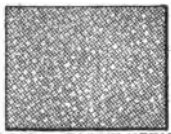


BRASS
Indian Yellow.

F

BRONZE
Burnt Umber.

G

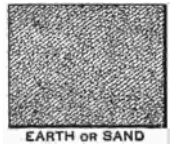


LEAD OR BABBIT METAL
Payner Grey.

H

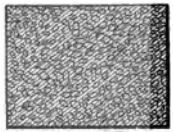
INDIA RUBBER
India Ink Black.

I



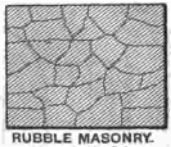
EARTH OR SAND
Sepia.

J



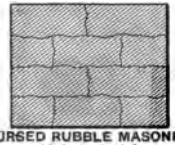
CONCRETE
Yellow Ochre.

K



RUBBLE MASONRY.
Light India Ink.

L

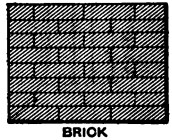


COURSED RUBBLE MASONRY
Light India Ink.

M

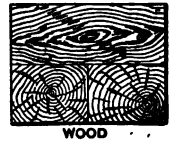
CUT STONE MASONRY
Light India Ink.

N



BRICK
Venetian Red.

O



WOOD
Raw Sienna.

SIZES WE CAN ROLL.

ROUNDS.			SQUARES.	
DIAMETER. INCHES.	DIAMETER. INCHES.	DIAMETER. INCHES.	SIDE. INCHES.	SIDE. INCHES.
7½	3⅜	1 3/16	4	1
7⅜	3⅝	1⅛	3¾	15/16
7	3½	1 1/16	3½	⅞
6⅞	3⅜	1	3¼	13/16
6¾	3¼	15/16	3	¾
6⅝	3⅛	⅞	2¾	11/16
6½	3	13/16	2⅝	⅝
6⅜	2⅞	¾	2½	9/16
6¼	2¾	11/16	2⅜	17/32
6⅛	2⅝	⅝	2¼	½
6	2½	9/16	2⅛	15/32
5⅞	2⅜	17/32	2	7/16
5¾	2¼	½	1 15/16	13/32
5⅝	2⅛	15/32	1⅞	⅜
5½	2	7/16	1 13/16	11/32
5⅜	1 15/16	13/32	1¾	5/16
5¼	1⅞	⅜	1 11/16	9/32
5⅛	1 13/16	11/32	1⅝	¼
5	1¾	5/16	1 9/16	7/32
4⅞	1 11/16	No. 2	1½	9/16
4¾	1⅝	9/32	1 7/16	
4⅝	1 9/16	No. 3	1⅜	
4½	1½	¼	1 5/16	
4⅜	1 7/16	No. 4	1¼	
4¼	1⅜	7/32	1 3/16	
4⅛	1 5/16	5/16	1⅛	
4	1¼		1 1/16	
3⅞				

OVAL.

1½, 1¼, 1⅛, 1, ⅞, ¾, ⅝, ½, 7/16, ⅜, 5/16.

HALF OVAL.

2½, 2, 1¾, 1½, 1¼, 1⅛, 1, ⅞, ¾, ⅝, 9/16, ½, 7/16, ⅜, 5/16.

HALF ROUND.

2, 1¾, 1½, 1¼, 1⅛, 1, ⅞, ¾, ⅝, 9/16, ½, 7/16, ⅜, 5/16.

SIZES WE CAN ROLL.

FLATS.

$22\frac{1}{2} \times \frac{5}{16}$ to $\frac{1}{4}$.

14, 12, 10, 9, $8\frac{1}{2}$, 8, $7\frac{1}{2}$, $7\frac{1}{2}$, $7\frac{1}{2}$, 7, $6\frac{1}{2}$, $6\frac{1}{2}$, 6, $5\frac{1}{2}$, $5\frac{1}{2}$, $5\frac{1}{2}$, 5, $4\frac{1}{2}$, $4\frac{1}{2}$, 4, $3\frac{1}{2}$, $3\frac{1}{2}$, $3\frac{1}{2}$, $3\frac{1}{2}$, $3\frac{1}{2}$, $3\frac{1}{2}$, 3, $2\frac{7}{8}$, $2\frac{1}{2}$, $2\frac{5}{8}$ and $2\frac{1}{2}$, $\times \frac{1}{4}$ to 2.

$2\frac{1}{2}$, $2\frac{1}{2}$, 2, $1\frac{7}{8}$, $1\frac{13}{16}$ and $1\frac{3}{4} \times \frac{5}{16}$ to $1\frac{1}{2}$.

$1\frac{11}{16}$, $1\frac{5}{8}$, $1\frac{9}{16}$ and $1\frac{1}{2} \times \frac{5}{16}$ to $1\frac{1}{4}$.

$1\frac{7}{16}$, $1\frac{3}{8}$, $1\frac{5}{16}$ and $1\frac{1}{4} \times \frac{5}{16}$ to 1.

$1\frac{3}{16}$, $1\frac{1}{8}$ and $1 \times \frac{5}{16}$ to $\frac{7}{8}$.

$\frac{7}{8}$ and $\frac{3}{4} \times \frac{5}{16}$ to $\frac{5}{8}$.

$\frac{5}{8} \times \frac{5}{16}$ to $\frac{9}{16}$.

$\frac{1}{2} \times \frac{5}{16}$ to $\frac{7}{16}$.

HOOPS AND SANDS.

$22\frac{1}{2} \times \frac{1}{2}$.

10, 9, $8\frac{1}{2}$, 8, $7\frac{1}{2}$, $7\frac{1}{2}$, 7, $6\frac{1}{2}$, $6\frac{1}{2}$, 6, $5\frac{1}{2}$, $5\frac{1}{2}$, 5 and $4\frac{1}{2}$, $\times$ No. 11 to No. 4.

4, $3\frac{1}{2}$, $3\frac{1}{2}$, $3\frac{1}{2}$, $3\frac{1}{2}$ and $3\frac{1}{8} \times$ No. 11 to $\frac{1}{2}$.

3, $2\frac{7}{8}$, $2\frac{1}{2}$ and $2\frac{5}{8} \times$ No. 16 to $\frac{1}{2}$.

$2\frac{1}{2}$, $2\frac{1}{2}$, $2\frac{1}{8}$ and $2 \times$ No. 16 to $\frac{1}{2}$.

$1\frac{7}{8}$, $1\frac{13}{16}$, $1\frac{3}{4}$ and $1\frac{11}{16} \times$ No. 17 to $\frac{1}{2}$.

$1\frac{5}{8}$, $1\frac{9}{16}$, $1\frac{1}{2}$ and $1\frac{7}{16} \times$ No. 18 to $\frac{1}{2}$.

$1\frac{3}{8}$, $1\frac{5}{16}$, $1\frac{1}{4}$ and $1\frac{3}{16} \times$ No. 20 to $\frac{1}{2}$.

$1\frac{1}{8}$, $1\frac{1}{16}$, 1 and $\frac{15}{16} \times$ No. 20 to $\frac{1}{2}$.

$\frac{7}{8}$ and $\frac{13}{16} \times$ No. 21 to $\frac{1}{2}$.

$\frac{3}{4}$, $\frac{11}{16}$ and $\frac{5}{8} \times$ No. 22 to $\frac{1}{2}$.

$\frac{9}{16}$ and $\frac{1}{2} \times$ No. 23 to $\frac{1}{2}$.

$\frac{5}{8} \times$ No. 17 to $\frac{1}{2}$.

SHEET STEEL.

(Partridge Gauge.)

MADE ON CHILL ROLLS.

Thickness.	Width.	Maximum Length.
No. 30....	18″ to 30″.....	8 feet.
29....	18″ to 30″.....	8 "
28....	18″ to 30″.....	8 "
No. 27....		
26....	18″ to 30″.....	9 feet.
25....		
No. 24....	18″ to 30″.....	10 feet.
23....		
No. 22....		
21....	18″ to 36″.....	10 feet.
20....		
No. 19....	18″ to 36″.....	10 feet.
18....		
No. 17....	18″ to 36″.....	10 feet.
No. 16....	18″ to 42″.....	10 feet.
15....		
No. 14....	18″ to 36″.....	16 feet.
13....	37″ to 42″.....	12 "
No. 12....		
11....	18″ to 36″.....	20 feet.
10....	37″ to 42″.....	12 "
9....		

PLATE STEEL.

MADE ON CHILL ROLLS.

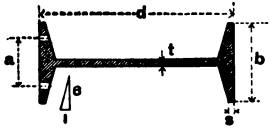
Thickness. Inches.	Width. Inches.	Maxi'm Length Feet.
No. 16	24 to 30	12
	31 to 36	10
	37 to 42	8
No. 14	24 to 30	14
	31 to 36	10
	37 to 42	8
No. 11 & 12	24 to 30	18
	31 to 36	15
	37 to 42	12
No. 10	24 to 30	24
	31 to 36	18
	37 to 42	14
No. 9	24 to 30	26
	31 to 36	20
	37 to 42	18
No. 8	24 to 30	28
	31 to 36	20
	37 to 42	16
No. 7 or $\frac{3}{16}$	24 to 30	30
	31 to 36	22
	37 to 42	18
$\frac{7}{32}$ & $\frac{1}{4}$	24 to 30	26
	31 to 36	20
	37 to 42	16
$\frac{5}{16}$	20 to 24	25
	25 to 30	20
	31 to 36	16
	37 to 42	12

PLATE STEEL.

MADE ON SAND ROLLS.

Thickness. Inches.	Width. Inches.	Maxi'm Length Feet.
$\frac{3}{16}$ & $\frac{1}{4}$	44 to 48	18
	49 to 52	16
$\frac{5}{16}$	44 to 48	16
	49 to 52	14
$\frac{3}{8}$	20 to 24	25
	25 to 30	20
	31 to 36	17
	37 to 42	15
	43 to 48	13
	49 to 52	11
$\frac{1}{2}$	20 to 24	20
	25 to 30	16
	31 to 36	13
	37 to 42	12
	43 to 48	10
	49 to 52	9
$\frac{5}{8}$	20 to 24	16
	25 to 30	13
	31 to 36	11
	37 to 42	9
	43 to 52	8
$\frac{3}{4}$	18 to 20	16
	20 to 24	14
	25 to 30	11
	31 to 36	9
	37 to 42	8
	43 to 52	7
$\frac{7}{8}$	18 to 20	14
	21 to 24	12
	25 to 30	9
	31 to 36	8
1	18 to 20	12
	21 to 24	10
	25 to 30	8
	31 to 36	7

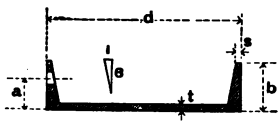
ELEMENTS OF STANDARD STEEL BEAMS.



d Ins	Weight per foot.	b Ins.	t Ins.	s Ins	a Ins	Size of holes.
20	100	7.294	0.894	0.65	4	$1\frac{3}{16}$"
	95	7.220	0.820			
	90	7.147	0.747			
	85	7.073	0.673			
	80	7.00	0.600			
20	80	6.485	0.735	0.55	$3\frac{1}{2}$	$1\frac{3}{16}$"
	75	6.412	0.662			
	70	6.338	0.588			
	64	6.25	0.500			
15	100	6.792	1.192	0.80	$3\frac{3}{4}$	$1\frac{5}{16}$"
	95	6.694	1.094			
	90	6.596	0.996			
	85	6.498	0.898			
	80	6.40	0.800			
15	80	6.392	0.982	0.59	$3\frac{3}{4}$	$1\frac{3}{16}$"
	75	6.294	0.884		$3\frac{1}{4}$	
	70	6.196	0.786		$3\frac{1}{4}$	
	65	6.098	0.688		$3\frac{1}{4}$	
	60	6.00	0.590		$3\frac{1}{4}$	
15	60	5.853	0.763	0.41	$3\frac{1}{4}$	$1\frac{3}{16}$"
	55	5.754	0.664		3	
	50	5.656	0.566		3	
	45	5.558	0.468		3	
	42	5.500	0.410		3	
12	55	5.618	0.828	0.46	3	$1\frac{3}{16}$"
	50	5.496	0.706			
	45	5.373	0.583			
	40	5.250	0.460			
12	40	5.208	0 558	0.35	3	$1\frac{3}{16}$"
	35	5.085	0.436		$2\frac{3}{4}$	
	31.5	5.000	0.35		$2\frac{3}{4}$	

d Ins	Weight per foot.	b Ins.	t Ins.	s Ins.	a Ins	Size of holes.
10	40	5.101	0.751	0.31	$2\frac{5}{8}$	$1\frac{3}{16}$"
	35	4.954	0.604			
	30	4.807	0.457			
	25	4.660	0.310			
9	35	4.787	0.747	0.29	$2\frac{1}{2}$	$1\frac{3}{16}$"
	30	4.624	0.584			
	25	4.461	0.421			
	21	4.330	0.290			
8	25.25	4.272	0.542	0.27	$2\frac{1}{4}$	$1\frac{1}{4}$"
	22.75	4.181	0.451			
	20.25	4.09	0.360			
	17.75	4.00	0.270			
7	20	3.87	0.460	0.25	$2\frac{1}{4}$	$1\frac{3}{16}$"
	17.5	3.765	0.355			
	15	3.66	0.250			
6	17.25	3.575	0.475	0.23	2	$1\frac{1}{16}$"
	14.75	3.453	0.353			
	12.25	3.330	0.230			
5	14.75	3.294	0.504	0.21	$1\frac{3}{4}$	$\frac{9}{16}$"
	12.25	3.147	0.357			
	9.75	3.000	0.210			
4	10.5	2.880	0.410	0.19	$1\frac{1}{2}$	$\frac{9}{16}$"
	9.5	2.806	0.336			
	8.5	2.733	0.263			
	7.5	2.660	0.190			
3	7.5	2.526	0.366	0.17	$1\frac{7}{16}$	$\frac{7}{16}$"
	6.5	2.428	0.268			
	5.5	2.330	0.170			

ELEMENTS OF STANDARD STEEL CHANNELS.



d Ins	Weight per foot.	b Ins.	t Ins.	s Ins	a Ins	Size of holes.	d Ins	Weight per foot.	b Ins.	t Ins.	s Ins	a Ins	Size of holes.
15	55	3.836	0.831	0.40	2 1/16	13/16"	7	19.75	2.510	0.630	0.20	1 1/16	7/16"
	50	3.733	0.733		2 1/16			17.25	2.405	0.525		1 1/16	
	45	3.638	0.636		2 1/16			14.75	2.300	0.420		1 1/16	
	40	3.538	0.538		1 15/16			12.25	2.195	0.315		1 1/16	
	35	3.440	0.440		1 15/16			9.75	2.090	0.210		1 1/16	
	33	3.400	0.400		1 15/16								
12	40	3.410	0.758	0.28	2	13/16"	6	15.50	2.288	0.568	0.20	1 1/16	7/16"
	35	3.290	0.636		2			13.00	2.166	0.446		1 1/16	
	30	3.170	0.513		2			10.50	2.043	0.323		1 1/16	
	25	3.050	0.390		1 13/16			8.00	1.920	0.200		1 1/16	
	20.5	2.940	0.280		1 13/16								
10	35	3.188	0.828	0.24	2	13/16"	5	11.50	2.044	0.484	0.19	1 1/16	3/8"
	30	3.041	0.681		2			9.00	1.897	0.337		1 1/16	
	25	2.894	0.534		2			6.50	1.750	0.190		1	
	20	2.747	0.378		1 1/16								
	15	2.600	0.240		1 1/16								
9	25	2.814	0.614	0.23	1 13/16	13/16"	4	7.25	1.727	0.327	0.18	1	3/8"
	20	2.651	0.451		1 13/16			6.25	1.654	0.254			
	15	2.478	0.288		1 13/16			5.25	1.580	0.180			
	13.25	2.430	0.230		1 13/16								
8	21.25	2.628	0.588	0.22	1 11/16	13/16"	3	6.00	1.606	0.366	0.17	15/16	7/16"
	18.75	2.536	0.496		1 11/16			5.00	1.508	0.268			
	16.25	2.444	0.404		1 11/16			4.00	1.410	0.170			
	13.75	2.352	0.312		1 11/16								
	11.25	2.260	0.220		1 11/16								

TEES.

WEIGHTS AND DIMENSIONS OF JONES & LAUGHLINS, LIMITED, TEES.

Section Number	Size in Inches.		Thickness of Metal.		Weight per Foot.
	Flange	Stem.	Flange.	Stem.	
T 20	4 in.	5 in.	¼ in. to ⅝ in.	¼ in. to ⅝ in.	16.00
T 21	4 "	4⅝ "	¼ " " ⅝ "	¼ " " ⅝ "	15.50
T 22	4 "	4¼ "	¼ " " ⅝ "	¼ " " ⅝ "	15.00
T 1	4 "	4 "	½ " " ⅝ "	½ " " ⅝ "	14.00
T 2	4 "	4 "	7/16 " " 17/32 "	7/16 " " 17/32 "	12.00
T 3	3½ "	3½ "	7/16 " " ½ "	7/16 " " ½ "	10.40
T 4	3½ "	3½ "	⅜ " " 7/16 "	⅜ " " 7/16 "	9.30
T 23	3½ "	3 "	7/16 " " ½ "	7/16 " " ½ "	9.80
T 24	3½ "	3 "	⅜ " " 7/16 "	⅜ " " 7/16 "	9.00
T 26	3 "	3½ "	7/16 " " ½ "	7/16 " " ½ "	9.00
T 25	3 "	3½ "	⅜ " " 7/16 "	⅜ " " 7/16 "	8.50
T 5	3 "	3 "	⅜ " " 7/16 "	⅜ " " 7/16 "	7.85
T 6	3 "	3 "	5/16 " " ⅜ "	5/16 " " ⅜ "	6.60
T 7	2½ "	2½ "	⅜ " " 7/16 "	⅜ " " 7/16 "	6.32
T 8	2½ "	2½ "	5/16 " " ⅜ "	5/16 " " ⅜ "	5.40
T 28	2½ "	2 "	5/16 " " 11/32 "	5/16 " " 11/32 "	4.80
T 9	2½ "	2½ "	5/16 " " 11/32 "	5/16 " " 11/32 "	4.62
T 10	2½ "	2½ "	¼ " " 9/32 "	¼ " " 9/32 "	4.12
T 11	2 "	2 "	¼ " " 9/32 "	¼ " " 9/32 "	3.50
T 27	2½ "	1⅞ "	¼ " " 9/32 "	¼ " " 9/32 "	3.90
T 13	1⅞ "	1⅞ "	¼ " " 9/32 "	¼ " " 9/32 "	3.00
T 12	1⅞ "	1⅞ "	3/16 " " 7/32 "	3/16 " " 7/32 "	2.33
T 14	1½ "	1½ "	¼ " " 9/32 "	¼ " " 9/32 "	2.62
T 15	1½ "	1½ "	3/16 " " 7/32 "	5/16 " " 7/32 "	1.90
T 16	1½ "	1½ "	¼ " " 9/32 "	¼ " " 9/32 "	1.95
T 17	1½ "	1½ "	3/16 " " 7/32 "	3/16 " " 7/32 "	1.55
T 18	1 "	1 "	3/16 " " 7/32 "	3/16 " " 7/32 "	1.25
T 19	1 "	1 "	⅛ " " 7/32 "	⅛ " " 7/32 "	0.90

JONES & LAUGHLINS, LIMITED, STANDARD ANGLES.

Weights per foot, corresponding to thickness varying by $\frac{1}{16}$ inch.

EQUAL LEGS.

Size in Inches.	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8
6 x 6	....	....	....	....	....	17.2	19.6	21.9	24.2	26.4	28.7	30.9	33.1
4 x 4	3 5/7		....	8.2	9.7	11.2	12.8	14.2	15.7	17.1	18.5	....	....
3½ x 3½	3.7		5.7	7 1	8.5	9.8	11.1	12.3	13.5	....	....	....	...
3 x 3	2.6	....	4.9	6.0	7.2	8.3	9.4	10.4	11.4	....	....	....	....
2½ x 2½	2.1	....	4.0	5.0	5.9	6.8	7.7	....	....	....	....	...	....
2 x 2	1.7	2.4	3.2	3.9	4.6	5.3	....	...	....	....	....	....	....
1¾ x 1¾	1.4	2.1	2.8	3.4	4.0	4.6	....	....	....	....	....	....	....
1½ x 1½	1.2	1.8	2.3	2.9	3.3	....	....	....	....	....	....	....	....
1¼ x 1¼	1.0	1.5	1.9	....	....	....	....	....	....	....	....	....	....
1 x 1	0.8	1.2	....	....	....	....	....	....	....	....	...	....	....
¾ x ¾	0.6	.8	....	...	....	....	....	....	....	....	....	.. .	..

UNEQUAL LEGS.

Size in Inches.	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8
6 x 4	. . .	..	....	....	12.3	14.2	16.2	18.1	19.9	21.8	23.6	25.4	27.1
6 x 3½	....	....	....	...	11.6	13.5	15.3	17.1	18.9	20.6	22.3	24.0	25.7
5 x 3½	....	....	....	....	10.4	12.0	13.6	15.2	16.7	18.3	19.8	....	...
5 x 3	....	. .	. ..	8.2	9.7	11.2	12.8	14.2	15.7	17.1	18.5	....	...
4 x 3	....	....	....	7.1	8.5	9.8	11.1	12.3	13.5	14.8	15.9	....	. ..
3½ x 3	....	..	....	6.6	7.8	9.0	10.2	11.4	12.5	....	....	....	....
3½ x 2½	....	....	4.9	6.0	7.2	8.3	9.4	10.5	....	...	....	....	....
3 x 2½	...	....	4.5	5.5	6.5	7.5	8.5	....	....	....	....	....	....
2½ x 2	....	2.8	3.6	4.5	5.3	6.0	6.8	....	....	...	....	....	....

SPECIAL SECTIONS OF STEEL ANGLES.

Weights per foot, corresponding to thickness varying by $\frac{1}{16}$ inch.

EQUAL LEGS.

Sizes, Inches.	1/16	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8
5 x 5		3/32	....	....	12.3	14.2	16.2	18.1	19.9	21.8	23.6	25.4	27.1
3½ x 3½		3.4	....	....	7.8	9.0	10.2	11.4	12.5	13.6	14.7	....	....
2½ x 2½	2.4	....	4.5	5.5	6.5	7.5	8.5	....	....	....	....	....	....
2¼ x 2¼	....	....	3.6	4.5	5.3	6.0	6.8	....	....	....	....	....	....

UNEQUAL LEGS.

Sizes, Inches.	1/16	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8
5 x 4	....	....	....	....	11.0	12.8	14.5	16.1	17.8	19.4	21.0	22.6	24.2
4 x 3½	....	....	....	....	9.1	10.5	11.9	13.3	14.6	15.9	17.2	....	...
3½ x 2½	....	....	...	6.4	7.7	8.8	10.0	11.1	12.2	13.3	14.3	....	....
3¼ x 2	....	....	4.3	5.3	6.2	7.2	8.1	....	....	....	..	....	....
3 x 2	....	3.1	4.0	5.0	5.9	6.8	7.7	....	....	....	....	....	...
2½ x 1¾	....	2.6	....	....	....	....	....	....	....	....	....	....	....
2½ x 1½	....	2.4	3.2	3.9	4.6	5.3	6.0	....	....	....	....	....	....
2 x 1½	....	2.1	2.8	3.4	4.0	....	....	....	....	....	....	....	....
2 x 1⅜	....	2.0	2.7	3.3	3.8	....	....	....	....	....	....	....	....
1¾ x 1½	....	....	2.6	....	....	....	....	....	....	....	....	....	....
1 x ¾	....	1.0	....	....	....	....	....	....	....	....	..	....	....

AREAS OF STANDARD ANGLES VARYING BY $\frac{1}{16}$ INCH IN THICKNESS.

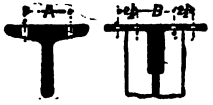
Size.	$\frac{1}{8}''$	$\frac{3}{16}''$	$\frac{1}{4}''$	$\frac{5}{16}''$	$\frac{3}{8}''$	$\frac{7}{16}''$	$\frac{1}{2}''$	$\frac{9}{16}''$	$\frac{5}{8}''$	$\frac{11}{16}''$	$\frac{3}{4}''$	$\frac{13}{16}''$	$\frac{7}{8}''$
6 x 6	.....	.....	.....	.....	.....	5.06	5.75	6.43	7.11	7.78	8.44	9.09	9.74
6 x 4	.....	.....	.....	.....	3.61	4.18	4.75	5.31	5.86	6.41	6.94	7.47	7.99
6 x $3\frac{1}{2}$	.....	.....	.....	.....	3.42	3.97	4.50	5.03	5.55	6.06	6.56	7.06	7.55
5 x $3\frac{1}{2}$	.....	.....	.....	.....	3.05	3.53	4.00	4.47	4.92	5.37	5.81	.....	....
5 x 3	.....	.....	.....	2.40	2.86	3.31	3.75	4.18	4.61	5.03	5.44	.....	.....
4 x 4	.....	.....	.....	2.40	2.86	3.31	3.75	4.18	4.61	5.03	5.44	.....	.....
4 x 3	.....	.....	.....	2.09	2.48	2.87	3.25	3.62	3.98	4.34	4.69	.....	.....
$3\frac{1}{2}$ x $3\frac{1}{2}$	.....	.....	1.69	2.09	2.48	2.87	3.25	3.62	3.98	.....	.....	.....	.....
$3\frac{1}{2}$ x 3	.....	.....	1.57	1.93	2.30	2.65	3.00	3.34	3.67	.....	.....	.....	.. ..
$3\frac{1}{2}$ x $2\frac{1}{2}$	.....	.....	1.44	1.78	2.11	2.43	2.75	.....	.....	.....	.....	.....	.....
3 x 3	.....	.....	1.44	1.78	2.11	2.43	2.75	3.06	.....	.....	.....	.....	.....
3 x $2\frac{1}{2}$	.....	.....	1.31	1.62	1.92	2.22	2.50	.....	.....	.....	.....	.....	.....
$2\frac{1}{2}$ x $2\frac{1}{2}$	.....	.....	1.19	1.47	1.73	2.00	2.25	.....	.....	.....	.....	.....	.....
$2\frac{1}{2}$ x 2	.....	0.81	1.06	1.31	1.55	1.78	2.00	.....	.....	.....	.....	.....	.....
2 x 2	0.48	0.71	0.94	1.15	1.36	1.56	.....	.....	.....	.....	.....	.....	.....
$1\frac{3}{4}$ x $1\frac{3}{4}$	0.42	0.62	0.81	1.00	1.17	1.30	.....	.....	.....	.....	.....	.....	.....
$1\frac{1}{2}$ x $1\frac{1}{2}$	0.36	0.53	0.69	0.84	0.99	.....	.....	.....	.....	.....	.....	.....	.....
$1\frac{1}{4}$ x $1\frac{1}{4}$	0.30	0.43	0.56	.....	.....	.....	.....	.....	.....	.....	.....	.....	.. ..
1 x 1	0.24	0.34	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
$\frac{3}{4}$ x $\frac{3}{4}$	0.17	0.25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

CAST SEPARATORS FOR BEAMS.

Separators for 20" beams are made of ⅝" metal.
" " 6" to 15" beams are made of ½" metal.
" " 5" beams and under are made of ⅜" metal.

Designation of Beam.			Distances.		Bolts.			Weights.			
Depth.	No. of Shape.	Weight.	Out to out of flanges of beams.	Center to center of beams.	Size.	Distance, center to center.	Length.	Bolts and nuts.	Increase in weight of separator bolts for 1 inch additional spread of beams.	Separator.	Increase in weight of separator for 1 inch additional spread of beams.
in.		lbs.	in.	in.	in.	in.	in.	lbs.	lbs.	lbs.	lbs.
SEPARATORS WITH TWO BOLTS.											
20	B–1	80	14¾	7¾	⅞	10	9½	4½	0.33	24¾	3 1/16
20	B–2	64	13¼	7	⅞	10	8½	4½	0.33	22	3 1/16
15	B–3	80	13⅝	6½	¾	7	9	3½	0.25	13½	1⅜
15	B–3	60	12½	6	¾	7	8	3¼	0.25	12½	1⅜
15	B–4	42	11½	6	¾	7	7½	3	0.25	11½	1 1/16
12	B–5	40	11	5¾	¾	6½	7½	3	0.25	9¼	1 7/16
12	B–6	31½	10¼	5¾	¾	6½	7⅛	3	0.25	9½	1⅜
SEPARATORS WITH ONE BOLT.											
12	B– 5	40	11	5¾	¾	...	7½	1½	0.12	9¼	1 7/16
12	B– 6	31½	10¼	5¾	¾	...	7⅛	1½	0.12	9½	1⅜
10	B– 7	40	11	6	¾	...	7⅜	1⅜	0.12	7	1 9/16
10	B– 7	25	10¼	5½	¾	...	6⅞	1⅜	0.12	7¼	1¼
9	B– 8	35	10¼	5½	¾	...	7¼	1⅜	0.12	6½	1 1/16
9	B– 8	21	9⅜	5	¾	...	6¼	1⅜	0.12	6	1⅛
8	B– 9	25½	9¼	5	¾	...	6½	1⅜	0.12	5½	1 5/16
8	B– 9	17¾	8¼	4¾	¾	...	6	1⅜	0.12	5½	1 5/16
7	B–10	20	8⅝	4½	¾	...	6¼	1¼	0.12	4½	1⅜
7	B–10	15	8⅛	5	¾	...	5¾	1¼	0.12	4½	1 5/16
6	B–11	17½	7⅛	4	¾	...	5½	1¼	0.12	2½	½
6	B–11	12¼	7⅛	3¾	¾	...	5	1¼	0.12	2¼	9 1/16
5	B–12	14¾	7	3¾	¾	...	5¼	1⅛	0.12	1¾	7 1/16
5	B–12	9¾	6⅛	3½	¾	...	4¾	1⅛	0.12	1¾	7 1/16
4	B–13	7⅛	5⅞	3¼	¾	...	4½	1⅛	0.12	1½	⅝
3	B–14	5½	5¼	3	¾	...	4¼	¾	0.12	1½	¼

STANDARD SPACING AND DIMENSIONS OF RIVET AND BOLT HOLES THROUGH FLANGES OF BEAMS AND CHANNELS AND CONNECTION ANGLES.



STEEL BEAMS.					STEEL CHANNELS.					ANGLES.		
Depth in inches.	Weight per foot. Lbs.	Diameter of Bolt or Rivet. Inches.	A Inches.	B Inches.	Depth in inches.	Weight per foot. Lbs.	Diameter of Bolt or Rivet. Inches.	A Inches.	B Inches.	Depth of Leg. Inches.	Max. Diam. of Bolt or Rivet. Inches.	C Inches.
20	80	¾	4	5⅛	15	45	¾	2¼	4 5/16	6	1	3⅛
20	64	¾	3⅛	5	15	33	¾	1 7/16	4 7/16	5	1	2¾
15	80	¾	3¾	5	12	30	¾	2	4⅛	4	1	2¼
15	60	¾	3¼	4 5/8	12	20.5	¾	1⅜	4 5/16			
15	42	¾	3	4 7/16	10	25	¾	2	4 5/16	3⅛	1	2
12	40	¾	3	4⅛	10	15	¾	1⅛	4¼	3¼	⅞	1⅝
12	31.5	¾	2¾	4⅜						3	⅞	1⅝
					9	20	¾	1⅜	4 7/16			
10	25	¾	2⅝	4 5/16	9	13.25	¾	1⅜	4¼	2¾	¾	1½
9	21	¾	2⅓	4 5/16	8	16.25	¾	1½	4 7/16	2⅓	¾	1⅜
8	17.75	¾	2¼	4¼	8	11.25	¾	1¼	4¼			
					7	17.25	¾	1½	4 9/16	2¼	¾	1¼
7	15	⅝	2¼	4¼	7	9.75	¾	1¼	4¼	2	⅝	1⅛
6	12.25	⅝	2	4¼	6	13	⅝	1⅜	4 7/16	1¾	⅝	1 5/16
5	9.75	½	1¾	4¼	6	8	⅝	1⅛	4 5/16	1⅜	½	1⅜
4	7.5	½	1½	4 5/16	5	11.5	½	1¼	4⅜	1¼	½	1 1/16
3	5.5	⅜	1 7/16	4 5/16	5	6.5	½	1	4 5/16	1	⅜	⅞
					4	5.25	½	1	4 5/16			
...	...	...	...	...						¾	¼	⅞
...	...	...	...	...	3	4	⅜	15/16	4 5/16			

The spaces "B" correspond with spacing given on page 62 for Standard Connection Angles.

NOTES ON STANDARD CONNECTION ANGLES FOR JONES & LAUGHLINS, LIMITED, BEAMS.

The Standard Connection Angles for Jones & Laughlins, Limited, Steel Beams, illustrated on opposite page, are designed for an allowed shearing strain of 10,000 pounds per square inch, and a bearing strain of 20,000 pounds per square inch on rivets or bolts corresponding with an extreme fibre strain of 16,000 pounds per square inch in the beam. The minimum span length at and above which the standard connections can be used with safety (the beam being loaded with its full capacity) are shown in the tables below. For shorter spans (the beam being loaded with its full capacity) additional strength in the connection should be made.

TABLE OF MINIMUM SPANS FOR JONES & LAUGHLINS, LIMITED, STEEL BEAMS FOR WHICH STANDARD CONNECTION ANGLES MAY BE SAFELY USED WITH BEAMS LOADED TO THEIR FULL CAPACITY.

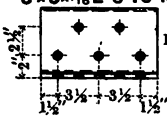
Section No.	Size of Beam.	Weight per foot.	Minimum Safe Span in feet.	Section No.	Size of Beam.	Weight per foot.	Minimum Safe Span in feet.
B 3	15 in.	80	12.6	B 9	8 in.	25¼	7.6
B 3	15 "	70	12.0	B 9	8 "	17¾	7.0
B 4	15 "	60	11.6	B 10	7 "	20	6.0
B 4	15 "	50	11.0	B 10	7 "	15	5.6
B 4	15 "	42	10.6	B 11	6 "	17½	6.6
B 5	12 "	40	8.6	B 11	6 "	12½	6.0
B 6	12 "	31½	7.6	B 12	5 "	14¾	4.0
B 7	10 "	35	10.6	B 12	5 "	9¾	4.0
B 7	10 "	25	9.0	B 13	4 "	10½	3.0
B 8	9 "	25	9.6	B 13	4 "	7½	3.0
B 8	9 "	21	8.6	.....	.....	.....	.....

STANDARD CONNECTION ANGLES FOR STEEL BEAMS.

4″ × 4″ × 5/16 L 1′ 3″ long

For 20″ Beams.

6″ × 6″ × 7/16 L 0′ 10″ long

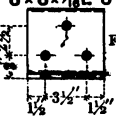


For 15″ Beams.

6″ × 6″ × 7/16 L 0′ 8½″ long

For 12″ Beams.

6″ × 6″ × 7/16 L 0′ 6½″ long

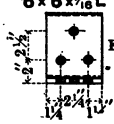


For 10″ Beams.

6″ × 6″ × 7/16 L 0′ 5″ long

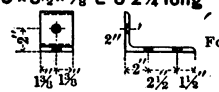
For 8″ and 9″ Beams.

6″ × 6″ × 7/16 L 0′ 4¾″ long



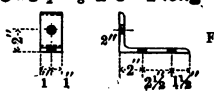
For 7″ Beams.

6″ × 3½″ × 5/8 L 0′ 2¾″ long



For 6″ and 5″ Beams.

6″ × 3½″ × 5/8 L 0′ 2″ long



For 4″ and 3″ Beams.

All holes for ¾″ bolts or rivets.

BUILT COLUMN SECTIONS.
Light lines indicate lattice.

Fig. 1

Fig. 2

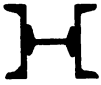


Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 8

Fig. 9

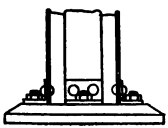
Fig. 10

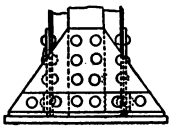
Fig. 11

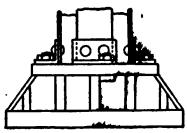
Fig. 12

Fig. 13

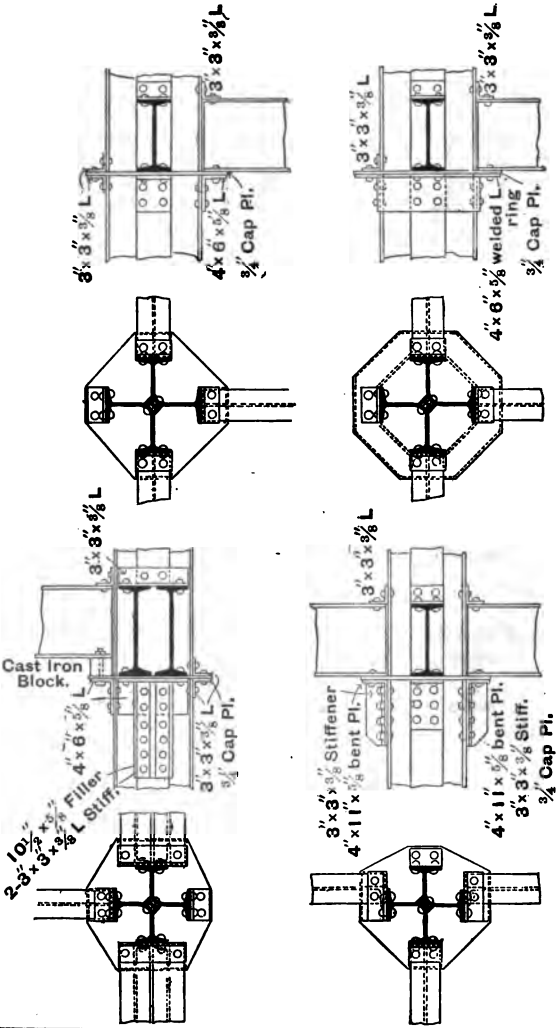
DETAILS OF BASES FOR LARIMER COLUMNS.



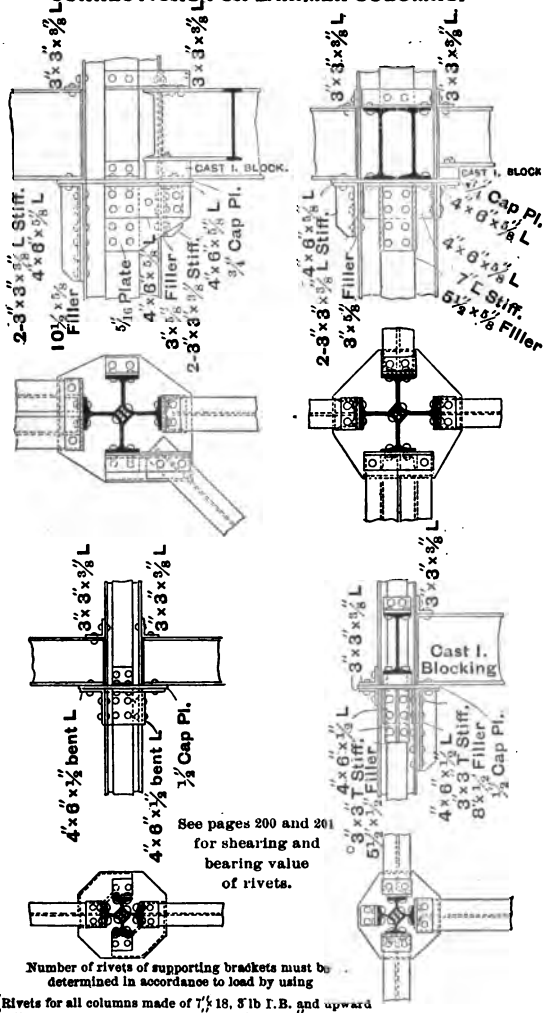




CONNECTIONS FOR LARIMER COLUMNS.



CONNECTIONS FOR LARIMER COLUMNS.



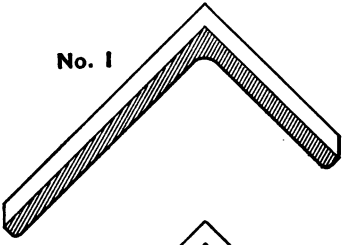
See pages 200 and 201 for shearing and bearing value of rivets.

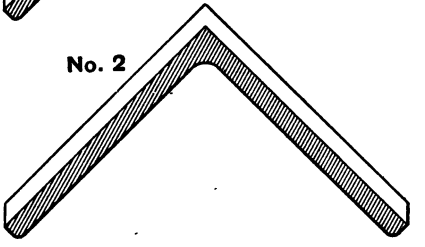
Number of rivets of supporting brackets must be determined in accordance to load by using

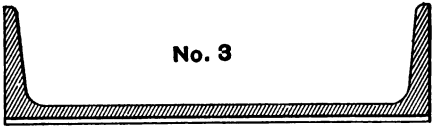
⅞" Rivets for all columns made of 7"×18, 3"lb I.B. and upward
⅝" " " " " " " 6"×12, 75 lb. to 7"×15, 25 lb. I. Bs.
½" " " " " " " 5"×16 lb. I. Bs. and less
One ¾" rivet may be allowed for the bending of a ¾" Cap Plate.

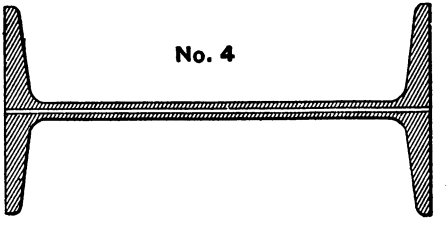
METHOD OF INCREASING SECTIONAL AREAS.

Dark portions represent the minimum sections, and the blank portions the added areas.

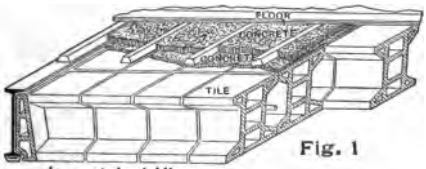








FIRE PROOF FLOORS.



Isometrical View. Fig. 1

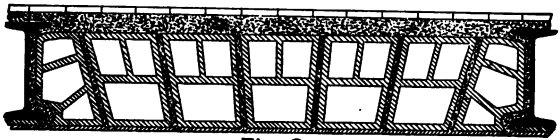


Fig. 2

Fig. 3

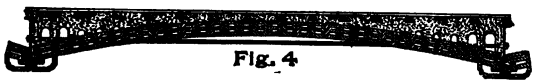


Fig. 4

Fig. 5

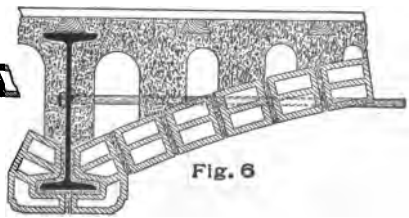


Fig. 6

FIRE PROOF FLOORS, PARTITIONS, CEILINGS and ROOFS.

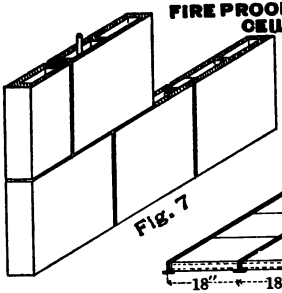


Fig. 7

Fig. 8

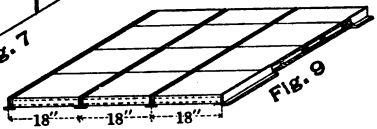


Fig. 9

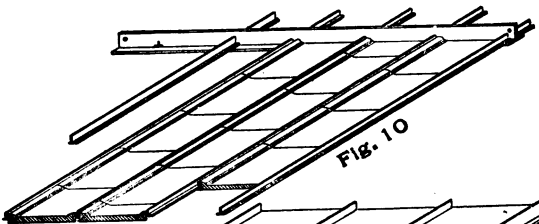


Fig. 10

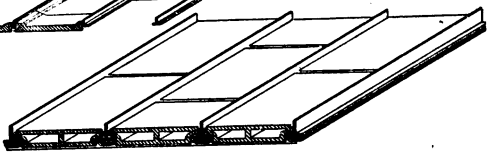


Fig. 11

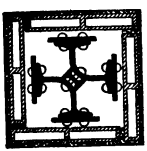


Fig. 12

Fig. 13

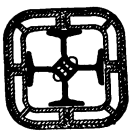


Fig. 14

Fig. 15

Fig. 16

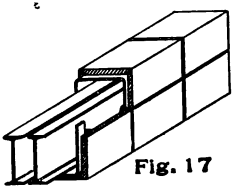
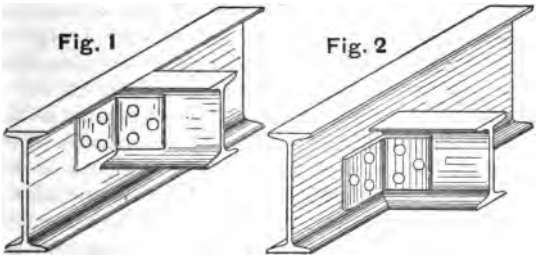
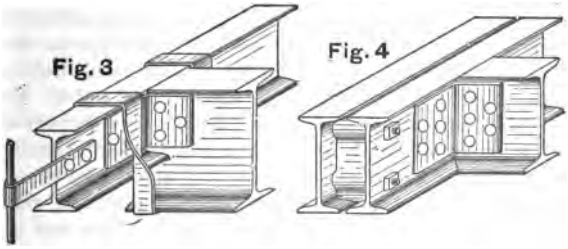
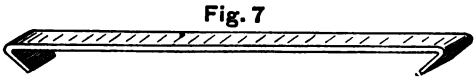


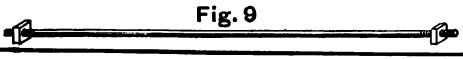
Fig. 17

GENERAL DETAILS OF FLOORS AND CONNECTIONS.









formed between the flanges, without necessitating the cutting of longitudinal webs, usual in the less modern form of arch shown in Fig. 2. Floor arches are generally designed to fill the space between the beams to within one inch of the top, and are set one inch below the soffits, thus allowing the bottom flange of the beam to be protected from fire by a "beam tile" one inch thick, held securely in place by the V-shaped projection of the "abutment" tile on each side of the beam. The "end section" arch is made for any sized beam up to 15-inch. Should a 20-inch beam be used, the abutment pieces are formed to suit the flange of the beam, and the 6-inch space from the top of the arch to the top of the 20-inch beam is then filled in with a light hollow flat filling tile. It is difficult to determine the most economical depth of beam for floor construction unless all the data of the existing conditions be at hand. With the floor arch filling, however, it is generally accepted that from 9-inch to 15-inch deep beams give the best results. The span of the floor arches necessarily vary according to the framing of the steel work. It is not uncommon in practice where the "end section" arch is used to set the same in place between beams spaced 10′ 0″ from center to center, though this span should be accepted as the maximum for arches 12 inches in depth or more only.

A great many tests have been made as to strength of hollow tile arches, both by still load and falling of heavy weights, and in every case the "end section" method has demonstrated its greater efficiency over the older systems. The usual manner of setting tile arches is by the use of portable scaffolds formed of 2×10 plank, supported underneath by "center stringers," which in turn are carried by bolts attached to cross pieces resting on the tops of the beams. After the tile arches have been set in cement mortar for thirty-six hours, the center scaffolding is removed and the tops of the arches are then filled in with cement concrete to the required level, 2×4 wooden sleepers being bedded in the concrete to afford nailing surface for the wood flooring; or if marble or mosaic flooring is required, the wood strips are omitted.

Fig. 2 illustrates an average of the old style method of floor arch construction. This system has been extensively used, and with generally satisfactory results. Its application is identical with the description given for Fig. 1, but as the hollows in all the tiles forming the arch run parallel with the beams, not over twenty-five per cent. of the sectional area of each tile is in compression. Hence, to obtain the required strength for the loads imposed, it is necessary to increase the thickness of the web and shell of the tile, thus increasing its weight. A comprehensive example of the relative strength of the "end system," as compared with the older methods, would be clearly illustrated by applying a pressure upon an egg endwise or upon its sides.

Table of weights, etc., for various sizes of Fireproof Floor Arches:

Depth of Arch.	Description.	Maximum Safe Span.	Weight per Square Foot.
7-inch.	Standard.	5′ 0″	25 pounds.
8-inch.	"	5′ 6″	29 "
9-inch.	End Section.	7′ 0″	25 "
12-inch.	" "	10′ 0″	35 "
15-inch.	" "	11′ 0″	45 "
5-inch.	Segment.	16′ 0″	28 "
6-inch.	"	20′ 0″	35 "

The weights given above do not include the concrete filling on top of arches. The safe span given for segment arches contemplates a rise of not less than 1½ inch to the foot run. Should a greater rise be permissable the span could be increased proportionately.

Fig. 3 illustrates a hollow tile arch between beams with a segment soffit and flat top. This form of arch has been extensively used in breweries, warehouses, etc., where the necessity for a level ceiling did not exist.

Fig. 4 represents a segment hollow tile arch set in place between beams spaced 18 feet from center to center. The tiles forming this arch are 6″×6″ square with outside shell ½-inch thick, and center web ½-inch thick. This form of

arch costs less than the flat systems shown in Figs. 1 and 2, effecting as it does a considerable saving in steel beams. Its use is becoming general for warehouses, malt houses and also office structures, although great care is necessary in the arrangement of steel framing to anticipate the thrust by the proper distribution of tie rods.

Fig. 6 shows in detail the abutment piece completely inclosing the steel beam, also the concrete filling in haunches cored out with metallic cores to lighten the weight of the floor; the wood strips are shown embedded in the concrete, same as described above.

Segment arches the sizes described have been built of 6-inch tile with a span of 18 feet, having 14 inches rise in the center, and tested to carry 300 pounds per foot, with factor of six for safety. Segment arches of 5-inch and 4-inch thick tile are used for smaller spans, and effect considerable saving when a level ceiling is not essential.

Fig. 5 shows method of fire proofing a beam or girder built in a floor that projects below the ceiling line. When desired special formed tile can be made to suit the outline required for ornamental cornices, etc.

On page 68, Figs. 15, 16 and 17 illustrate single and double isolated steel girders inclosed with fire proofing material, and finished out to the plaster line. On same page, Fig. 9 illustrates method of constructing mansard or flat fireproof roofs. For this purpose tees of the required weight are used, spaced 18 inches from center to center. Between the tees hollow tiles 12″×18″ are bedded in cement mortar and left ready for the weathering. On steep pitched and mansard roofs the porous tiles are preferable, as the the slates or roofing tiles can be nailed directly to the same. Fig. 10 illustrates a fireproof ceiling constructed by a combination of steel and tile. The main supports are constructed of 3×3 angles spaced six feet from center to center, punched at regular intervals of 12-inch centers, with triangular holes of sufficient size to permit 1″×1″ tees passing through the same. The 3×3 angles are supported by rods of the required length from the roof rafters at intervals of 8 feet. After the

1″×1″ tees are set in place, ½-inch thick flat tiles with grooved edges are set in place between same and the under surface left ready for the receipt of the plaster. This form of fireproof ceiling is sufficiently strong to bear the weight of a man, but should not be used if required to carry anything but its own weight.

Fig. 11 shows tees and tile construction suited for ceilings or attic floors of fireproof buildings. The tees are spaced 16 inches from center to center, 3-inch thick tiles being bedded between same; the soffits of the tees are protected with a slab of tile A thin coat of cement mortar spread upon the tops of the tile leaves a finished surface suitable for attic floor. Figs. 12, 13 and 14 illustrate three different forms of fireproof covering applied to Larimer's Patent Steel Columns. These tiles are molded to suit any size or form of column, and are secured to each other with steel clamps, and to the column with suitable fastenings. Any form of steel column can be fireproofed in a like manner.

By fireproofing the Larimer column as shown, a channel or duct between the column and tile is formed, thus allowing ample space for all pipes, etc., to be carried up through the building without increasing the exterior dimensions of the column.

Figs. 7 and 8 show an isometrical view and plan of hollow tile partition. These tiles are manufactured from 2 to 6 inches thick, and are 12 inches square. They are laid in place in cement mortar, joints being regularly broken in every course. Steel clamps are used to tie the tiles together whenever the walls are of unusual heights.

DEFLECTION COEFFICIENTS FOR DIFFERENT SHAPES GIVEN IN 64THS OF AN INCH.

Coefficient Index.	DISTANCE BETWEEN SUPPORTS IN FEET.								
	6	8	10	12	14	16	18	20	22
C	38.0	68.0	106.0	152.5	208.0	271.0	343.0	424.0	513.0
C′	30.0	53.0	83.0	119.0	162.0	212.0	268.0	331.0	400.5
	DISTANCE BETWEEN SUPPORTS IN FEET.								
	24	26	28	30	32	34	36	38	40
C	610.0	716.0	830.5	953.0	1085.0	1225.0	1373.0	1530.0	1695.0
C′	477.0	559.0	642.0	748.0	847.0	957.0	1073.0	1195.0	1324.0

The figures given opposite C and C′ are the Deflection Coeffieients for steel shapes subject to transverse strain for varying spans, under their maximum uniformly distributed safe loads, derived from a fiber strain of 16,000 and 12,500 respectively, the modulus of elasticity being taken at 29,000,000.

To find the deflection of any symmetrical shape used as a beam, under its corresponding safe load, divide the coefficients given in the above tables by the depth of the beam. This applies to such shapes as beams, channels, etc. For those shapes having unsymmetrical axes, such as tees, angles, etc., divide by twice the greatest distance of the neutral axis from the outside fiber.

Example:—Required the deflection of a 10-inch beam, 25 lbs. per foot, 20-foot span, under its maximum uniformly distributed safe load of 6.51 tons as given on page 84. The above tables give 424.0 as the deflection coefficient; dividing this by 10 gives 42 as the required deflection in 64ths of an inch. For deflections due to different systems of loading, see page 177.

SAFE LOADS, UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, STEEL BEAMS.

IN TONS OF 2,000 LBS.

Distance in feet between supports.	24 Inch Beam, Standard.				
	100 lbs.	95 lbs.	90 lbs.	85 lbs.	80 lbs.
10	105.32	102.18	99.04	95.90	92.76
11	95.74	92.89	90.04	87.18	84.33
12	87.76	85.15	82.53	79.92	77.30
13	81.01	78.60	76.18	73.77	71.36
14	75.23	72.99	70.74	68.50	66.26
15	70.21	68.12	66.03	63.93	61.84
16	65.82	63.86	61.90	59.90	57.97
17	61.95	60.10	58.26	56.41	54.57
18	58.51	56.76	55.02	53.28	51.53
19	55.42	53.78	52.13	50.47	48.82
20	52.66	51.09	49.52	47.95	46.38
21	50.15	48.66	47.16	45.67	44.17
22	47.87	46.44	45.02	43.59	42.16
23	45.79	44.43	43.06	41.69	40.33
24	43.88	42.57	41.27	39.96	38.65
25	42.13	40.87	39.62	38.36	37.11
26	40.51	39.30	38.09	36.88	35.68
27	39.01	37.84	36.68	35.52	34.36
28	37.61	36.49	35.37	34.25	33.13
29	36.31	35.23	34.15	33.07	31.99
30	35.11	34.06	33.01	31.97	30.92
31	33.97	32.96	31.95	30.94	29.92
32	32.91	31.93	30.95	29.97	28.98
33	31.91	30.96	30.01	29.06	28.11
34	30.98	30.05	29.13	28.20	27.28
35	30.09	29.19	28.30	27.40	26.50
36	29.25	28.38	27.51	26.64	25.76

Safe load includes weight of Beam. Maximum fiber strain of 16,000 lbs. per square inch.

SAFE LOADS, UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, STEEL BEAMS.

IN TONS OF 2,000 LBS.

Distance in feet between supports.	20 Inch Beam, Heavy Section.				
	100 lbs.	95 lbs.	90 lbs.	85 lbs.	80 lbs.
10	88.66	86.05	83.43	80.82	78.21
11	80.59	78.22	75.84	73.47	71.10
12	73.88	71.70	69.53	67.35	65.17
13	68.20	66.19	64.18	62.17	60.16
14	63.33	61.46	59.59	57.73	55.86
15	59.11	57.36	55.62	53.88	52.14
16	55.41	53.78	52.15	50.51	48.88
17	52.15	50.61	49.08	47.54	46.00
18	49.25	47.80	46.35	44.90	43.45
19	46.66	45.29	43.91	42.54	41.16
20	44.33	43.02	41.72	40.41	39.10
21	42.22	40.97	39.70	38.49	37.24
22	40.30	39.11	37.93	36.74	35.55
23	38.55	37.41	36.28	35.14	34.00
24	36.94	35.85	34.76	33.68	32.59
25	35.46	34.42	33.37	32.33	31.28
26	34.10	33.09	32.09	31.08	30.08
27	32.83	31.87	30.90	29.93	28.97
28	31.66	30.73	29.80	28.87	27.93
29	30.57	29.67	28.77	27.87	26.97
30	29.55	28.68	27.81	26.94	26.07
31	28.60	27.76	26.91	26.07	25.23
32	27.70	26.89	26.07	25.25	24.44
33	26.86	26.07	25.31	24.49	23.70
34	26.07	25.31	24.52	23.77	23.00
35	25.33	24.58	23.84	23.09	22.33
36	24.63	23.90	23.18	22.45	21.72

Safe load includes weight of Beam. Maximum fiber strain of 16,000 lbs. per square inch.

SAFE LOADS, UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, STEEL BEAMS.

IN TONS OF 2,000 LBS.

Distance in feet between supports.	20 Inch Beam, Standard.				
	80 lbs.	75 lbs.	70 lbs.	65 lbs.	64 lbs.
10	70.74	68.13	65.51	62.90	62.37
11	64.31	61.93	59.56	57.18	56.70
12	58.95	56.82	54.59	52.41	51.98
13	54.42	52.40	50.39	48.38	47.98
14	50.53	48.66	46.79	44.93	44.55
15	47.16	45.42	43.67	41.93	41.58
16	44.21	42.58	40.94	39.31	38.98
17	41.61	40.07	38.54	37.00	36.69
18	39.30	37.85	36.40	34.94	34.65
19	37.23	35.86	34.48	33.10	32.83
20	35.37	34.06	32.76	31.45	31.19
21	33.68	32.44	31.20	29.95	29.70
22	32.15	30.97	29.78	28.59	28.35
23	30.75	29.62	28.48	27.35	27.12
24	29.47	28.41	27.29	26.21	25.99
25	28.29	27.25	26.20	25.16	24.95
26	27.21	26.20	25.19	24.19	23.99
27	26.20	25.23	24.26	23.29	23.10
28	25.26	24.33	23.45	22.46	22.28
29	24.38	23.49	22.59	21.69	21.51
30	23.58	22.71	21.83	20.97	20.79
31	22.82	21.98	21.13	20.29	20.12
32	22.11	21.29	20.47	19.66	19.49
33	21.44	20.64	19.85	19.06	18.90
34	20.81	20.04	19.27	18.50	18.35
35	20.21	19.46	18.72	17.97	17.82
36	19.65	18.94	18.20	17.47	17.33

Safe load includes weight of Beam. Maximum fiber strain of 16,000 lbs. per square inch.

SAFE LOADS, UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, STEEL BEAMS.

IN TONS OF 2,000 LBS.

Distance in feet between supports.	15 Inch Beam, Heavy Section.				
	100 lbs.	95 lbs.	90 lbs.	85 lbs.	80 lbs.
10	63.96	62.00	60.04	58.08	56.11
11	58.14	56.36	54.58	52.80	51.01
12	53.30	51.66	50.03	48.40	46.76
13	49.20	47.69	46.18	44.67	43.17
14	45.68	44.28	42.88	41.48	40.08
15	42.64	41.33	40.02	38.72	37.41
16	39.97	38.75	37.52	36.30	35.07
17	37.62	36.47	35.32	34.16	33.01
18	35.53	34.44	33.35	32.26	31.17
19	33.66	32.63	31.60	30.57	29.52
20	31.98	31.00	30.02	29.04	28.06
21	30.45	29.52	28.59	27.66	26.73
22	29.07	28.18	27.29	26.40	25.51
23	27.81	26.96	26.10	25.25	24.40
24	26.65	25.83	25.01	24.20	23.38
25	25.58	24.80	24.01	23.23	22.45
26	24.60	23.84	23.09	22.34	21.58
27	23.69	22.96	22.24	21.51	20.78
28	22.84	22.14	21.44	20.74	20.04
29	22.05	21.38	20.70	20.03	19.35
30	21.32	20.67	20.01	19.36	18.70
31	20.63	20.00	19.37	18.73	18.10
32	19.99	19.37	18.76	18.15	17.54
33	19.38	18.79	18.19	17.60	17.00
34	18.81	18.23	17.66	17.08	16.50
35	18.27	17.71	17.15	16.59	16.03
36	17.76	17.22	16.68	16.13	15.59

Safe load includes weight of Beam. Maximum fiber strain of 16,000 lbs. per square inch.

SAFE LOADS, UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, STEEL BEAMS.

IN TONS OF 2,000 LBS.

Distance in feet between supports.	15 Inch Beam, Light Section.				
	80 lbs.	75 lbs.	70 lbs.	65 lbs.	60 lbs.
10	51.15	49.19	47.23	45.27	43.31
11	46.50	44.72	42.93	41.15	39.37
12	42.62	40.99	39.36	37.72	36.09
13	39.35	37.84	36.33	34.82	33.31
14	36.54	35.13	33.73	32.33	30.93
15	34.10	32.79	31.49	30.18	28.87
16	31.97	30.74	29.52	28.29	27.07
17	30.09	28.93	27.78	26.63	25.47
18	28.42	27.33	26.24	25.15	24.06
19	26.92	25.89	24.86	23.82	22.79
20	25.57	24.59	23.61	22.63	21.65
21	24.36	23.42	22.49	21.56	20.62
22	23.25	22.36	21.47	20.58	19.69
23	22.24	21.39	20.53	19.68	18.83
24	21.31	20.50	19.68	18.86	18.04
25	20.46	19.68	18.89	18.11	17.32
26	19.67	18.92	18.16	17.41	16.66
27	18.95	18.22	17.49	16.77	16.04
28	18.27	17.57	16.87	16.17	15.47
29	17.64	16.96	16.29	15.61	14.93
30	17.05	16.40	15.74	15.09	14.44
31	16.50	15.87	15.23	14.60	13.97
32	15.98	15.37	14.76	14.14	13.53
33	15.50	14.91	14.31	13.72	13.12
34	15.04	14.47	13.89	13.31	12.74
35	14.61	14.05	13.49	12.93	12.36
36	14.21	13.66	13.12	12.57	12.03

Safe load includes weight of Beam. Maximum fiber strain of 16,000 lbs. per square inch.

SAFE LOADS, UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, STEEL BEAMS.

IN TONS OF 2,000 LBS.

Distance in feet between supports.	15 Inch Beam, Standard.				
	60 lbs.	55 lbs.	50 lbs.	45 lbs.	42 lbs.
10	38.47	36.52	34.55	32.59	31.41
11	34.97	33.19	31.41	29.63	28.56
12	32.06	30.42	28.79	27.16	26.18
13	29.59	28.08	26.58	25.07	24.16
14	27.48	26.08	24.68	23.28	22.44
15	25.65	24.34	23.03	21.73	20.94
16	24.04	22.82	21.59	20.37	19.63
17	22.63	21.49	20.32	19.17	18.48
18	21.37	20.28	19.19	18.10	17.45
19	20.25	19.21	18.18	17.15	16.53
20	19.23	18.26	17.26	16.29	15.71
21	18.32	17.38	16.45	15.52	14.96
22	17.49	16.59	15.70	14.81	14.28
23	16.73	15.87	15.02	14.17	13.66
24	16.03	15.21	14.40	13.58	13.09
25	15.39	14.60	13.82	13.04	12.56
26	14.80	14.04	13.29	12.53	12.08
27	14.24	13.52	12.80	12.07	11.63
28	13.74	13.04	12.34	11.64	11.22
29	13.26	12.59	11.91	11.24	10.83
30	12.82	12.17	11.52	10.86	10.47
31	12.41	11.78	11.14	10.51	10.13
32	12.02	11.41	10.80	10.18	9.82
33	11.66	11.06	10.47	9.88	9.52
34	11.31	10.74	10.16	9.58	9.24
35	10.99	10.43	9.87	9.31	8.97
36	10.69	10.14	9.60	9.05	8.73

Safe load includes weight of Beam. Maximum fiber strain of 16,000 lbs. per square inch.

SAFE LOADS, UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, STEEL BEAMS.

IN TONS OF 2,000 LBS.

Distance in feet between supports.	12 Inch Beam, Special Section.				12 Inch Beam, Standard.		
	55 lbs.	50 lbs.	45 lbs.	40 lbs.	40 lbs.	35 lbs.	31½ lbs.
10	28.61	27.04	25.48	23.91	21.85	20.28	19.18
11	26.01	24.58	23.16	21.73	19.86	18.44	17.44
12	23.84	22.54	21.23	19.92	18.21	16.90	15.99
13	22.01	20.80	19.60	18.39	16.81	15.60	14.76
14	20.44	19.32	18.20	17.08	15.62	14.49	13.70
15	19.08	18.03	16.98	15.94	14.56	13.52	12.79
16	17.88	16.90	15.92	14.94	13.66	12.68	11.99
17	16.83	15.91	14.99	14.06	12.85	11.93	11.28
18	15.90	15.02	14.15	13.28	12.14	11.27	10.66
19	15.06	14.23	13.41	12.58	11.50	10.62	10.10
20	14.31	13.52	12.74	11.95	10.93	10.14	9.59
21	13.63	12.88	12.13	11.38	10.41	9.66	9.14
22	13.01	12.29	11.58	10.87	9.93	9.22	8.72
23	12.44	11.76	11.08	10.39	9.50	8.82	8.34
24	11.92	11.27	10.61	9.96	9.10	8.45	7.99
25	11.45	10.82	10.19	9.56	8.75	8.11	7.67
26	11.01	10.40	9.80	9.19	8.40	7.80	7.38
27	10.60	10.02	9.43	8.85	8.09	7.51	7.10
28	10.22	9.66	9.10	8.54	7.81	7.24	6.85
29	9.87	9.33	8.78	8.24	7.53	6.99	6.62
30	9.54	9.01	8.48	7.97	7.28	6.76	6.39
31	9.23	8.72	8.21	7.71	7.05	6.54	6.19
32	8.94	8.45	7.96	7.47	6.83	6.34	5.99
33	8.67	8.19	7.72	7.24	6.62	6.15	5.81
34	8.42	7.95	7.49	7.03	6.43	5.97	5.64
35	8.17	7.72	7.28	6.83	6.24	5.79	5.48
36	7.95	7.51	7.08	6.64	6.07	5.63	5.33

Safe load includes weight of Beam. Maximum fiber strain of 16,000 lbs. per square inch.

SAFE LOADS, UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, STEEL BEAMS.

IN TONS OF 2,000 LBS.

Distance in feet between supports.	10 Inch Beam, Standard.				9 Inch Beam, Standard.			
	40 lbs.	35 lbs.	30 lbs.	25 lbs.	35 lbs.	30 lbs.	25 lbs.	21 lbs.
10	16.94	15.64	14.33	13.02	13.35	12.18	11.00	10.06
11	15.40	14.22	13.03	11.85	12.14	11.07	10.00	9.15
12	14.12	13.03	11.94	10.85	11.12	10.15	9.17	8.39
13	13.03	12.03	11.02	10.02	10.27	9.36	8.46	7.74
14	12.10	11.17	10.24	9.30	9.53	8.70	7.86	7.19
15	11.30	10.42	9.55	8.68	8.90	8.12	7.34	6.71
16	10.59	9.77	8.96	8.14	8.34	7.61	6.88	6.29
17	9.97	9.20	8.43	7.66	7.85	7.16	6.47	5.92
18	9.41	8.69	7.96	7.24	7.42	6.76	6.11	5.60
19	8.92	8.23	7.54	6.85	7.03	6.41	5.79	5.30
20	8.47	7.82	7.16	6.51	6.67	6.09	5.50	5.03
21	8.07	7.45	6.82	6.20	6.36	5.80	5.24	4.79
22	7.71	7.11	6.51	5.92	6.07	5.53	5.00	4.57
23	7.37	6.80	6.23	5.66	5.80	5.29	4.78	4.36
24	7.06	6.52	5.97	5.43	5.56	5.07	4.58	4.19
25	6.78	6.25	5.73	5.21	5.34	4.87	4.40	4.02
26	6.52	6.01	5.51	5.01	5.13	4.68	4.23	3.87
27	6.27	5.79	5.31	4.82	4.94	4.51	4.07	3.73
28	6.05	5.58	5.12	4.65	4.77	4.35	3.93	3.59
29	5.83	5.39	4.94	4.49	4.60	4.20	3.79	3.47
30	5.65	5.21	4.77	4.34	4.45	4.06	3.67	3.35
31	5.46	5.04	4.62	4.20	.....	.....	.....	.....
32	5.29	4.89	4.48	4.07	.....	.....	.....	.....
33	5.13	4.74	4.34	3.95	.....	.....	.....	.....
34	4.98	4.60	4.21	3.83	.....	.....	.....	.....
35	4.84	4.47	4.09	3.72	.....	.....	.....	.....
36	4.71	4.34	3.98	3.62	.....	.....	.....	.....

Safe load includes weight of Beam. Maximum fiber strain of 16,000 lbs. per square inch.

SAFE LOADS, UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, STEEL BEAMS.

IN TONS OF 2,000 LBS.

Distance in feet between supports.	8 Inch Beam, Standard.				7 Inch Beam, Standard.		
	25¼ lbs.	22¾ lbs.	20¼ lbs.	17¾ lbs.	20 lbs.	17½ lbs.	15 lbs.
5	18.31	17.26	16.21	15.17	12.87	11.95	11.04
6	15.26	14.38	13.51	12.64	10.73	9.96	9.20
7	13.08	12.33	11.58	10.83	9.19	8.53	7.89
8	11.44	10.79	10.13	9.48	8.04	7.47	6.90
9	10.17	9.59	9.01	8.43	7.15	6.64	6.13
10	9.15	8.63	8.11	7.58	6.44	5.98	5.52
11	8.32	7.85	7.37	6.89	5.85	5.43	5.02
12	7.63	7.19	6.76	6.32	5.36	4.98	4.60
13	7.04	6.64	6.24	5.83	4.95	4.60	4.25
14	6.54	6.16	5.79	5.42	4.60	4.26	3.94
15	6.10	5.75	5.40	5.06	4.29	3.99	3.68
16	5.72	5.39	5.07	4.74	4.02	3.74	3.45
17	5.38	5.08	4.76	4.46	3.79	3.52	3.25
18	5.08	4.79	4.50	4.21	3.57	3.32	3.07
19	4.82	4.54	4.27	3.99	3.37	3.15	2.91
20	4.58	4.32	4.05	3.79	3.22	2.99	2.76
21	4.36	4.11	3.86	3.61	3.06	2.84	2.63
22	4.16	3.92	3.68	3.45	2.93	2.71	2.51
23	3.98	3.75	3.52	3.30	2.80	2.60	2.40
24	3.81	3.60	3.38	3.16	2.68	2.49	2.30
25	3.66	3.45	3.24	3.03	2.57	2.39	2.21

Safe load includes weight of Beam. Maximum fiber strain of 16,000 lbs. per square inch.

SAFE LOADS, UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, STEEL BEAMS.

IN TONS OF 2,000 LBS.

Distance in feet between supports.	6 Inch Beam, Standard.			5 Inch Beam, Standard.		
	17¼ lbs.	14¾ lbs.	12¼ lbs.	14¾ lbs.	12¼ lbs.	9¾ lbs.
5	9.31	8.53	7.74	6.47	5.81	5.16
6	7.76	7.11	6.45	5.39	4.84	4.30
7	6.65	6.09	5.53	4.62	4.15	3.68
8	5.82	5.33	4.84	4.04	3.63	3.22
9	5.17	4.74	4.30	3.59	3.23	2.87
10	4.66	4.26	3.87	3.23	2.91	2.58
11	4.23	3.88	3.52	2.94	2.64	2.34
12	3.88	3.55	3.23	2.69	2.42	2.15
13	3.58	3.28	2.98	2.49	2.24	1.98
14	3.33	3.05	2.77	2.31	2.08	1.84
15	3.10	2.84	2.58	2.16	1.94	1.72
16	2.91	2.66	2.42	2.02	1.82	1.61
17	2.74	2.51	2.28	1.90	1.71	1.52
18	2.59	2.37	2.15	1.80	1.61	1.43
19	2.45	2.24	2.04	1.70	1.53	1.36
20	2.33	2.13	1.93	1.62	1.45	1.29
21	2.22	2.03	1.84	1.54	1.38	1.23
22	2.12	1.94	1.76	1.47	1.32	1.17

Safe load includes weight of Beam. Maximum fiber strain of 16,000 lbs. per square inch.

SAFE LOADS UNIFORMLY DISTRIBUTED FOR JONES & LAUGHLINS, LIMITED, STEEL BEAMS.

IN TONS OF 2,000 LBS.

Distance in feet between supports.	4 Inch Beam, Stadanrd.				3 Inch Beam, Standard.		
	10½ lbs.	9½ lbs.	8½ lbs.	7½ lbs.	7½ lbs.	6½ lbs.	5½ lbs.
5	3.81	3.60	3.39	3.18	2.08	1.92	1.76
6	3.17	3.00	2.82	2.65	1.78	1.60	1.47
7	2.72	2.57	2.42	2.27	1.49	1.39	1.26
8	2.38	2.25	2.12	1.99	1.30	1.20	1.10
9	2.12	2.00	1.88	1.77	1.16	1.07	.98
10	1.90	1.80	1.70	1.59	1.04	.96	.88
11	1.73	1.64	1.54	1.45	.95	.87	.80
12	1.59	1.50	1.41	1.33	.87	.80	.73
13	1.46	1.39	1.30	1.22	.80	.74	.68
14	1.36	1.29	1.21	1.14	.74	.69	.63
15	1.27	1.20	1.13	1.06	.69	.64	.59
16	1.19	1.12	1.06	.99	.65	.60	.55
17	1.12	1.06	1.00	.94	.61	.56	.52
18	1.06	1.00	.94	.88	.58	.53	.49
19	1.00	.95	.89	.82	.55	.50	.46
20	.95	.90	.85	.79	.52	.48	.44
21	.91	.86	.81	.75	.50	.46	.42
22	.88	.82	.77	.72	.48	.44	.40

Safe load includes weight of Beam. Maximum fiber strain of 16,000 lbs. per square inch.

SAFE LOADS, UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, STEEL CHANNELS.

IN TONS OF 2,000 LBS.

Distance in feet between supports.	15 Inch Channel, Standard.					
	55 lbs.	50 lbs.	45 lbs.	40 lbs.	35 lbs.	33 lbs.
10	30.85	28.80	26.93	24.97	23.01	22.22
11	28.05	26.27	24.48	22.70	20.92	20.20
12	25.71	24.08	22.44	20.81	19.17	18.52
13	23.73	22.22	20.72	19.21	17.70	17.10
14	22.04	20.64	19.24	17.84	16.44	15.87
15	20.57	19.26	17.96	16.65	15.34	14.82
16	19.28	18.06	16.83	15.61	14.38	13.89
17	18.15	16.99	15.84	14.69	13.53	13.07
18	17.14	16.05	14.96	13.87	12.78	12.35
19	16.24	15.21	14.17	13.14	12.11	11.69
20	15.43	14.45	13.47	12.48	11.50	11.11
21	14.69	13.76	12.82	11.89	10.96	10.58
22	14.02	13.13	12.24	11.35	10.46	10.10
23	13.41	12.56	11.71	10.86	10.00	9.66
24	12.86	12.04	11.22	10.40	9.59	9.26
25	12.34	11.56	10.77	9.99	9.20	8.89
26	11.87	11.11	10.36	9.60	8.85	8.55
27	11.43	10.70	9.97	9.25	8.52	8.23
28	11.02	10.32	9.62	8.92	8.22	7.94
29	10.64	9.96	9.29	8.61	7.93	7.66
30	10.28	9.63	8.98	8.32	7.67	7.41

Safe load includes weight of Channel. Maximum fiber strain of 16,000 lbs. per square inch.

SAFE LOADS, UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, STEEL CHANNELS.

IN TONS OF 2,000 LBS.

Distance in feet between supports.	12 Inch Channels, Standard.				
	40 lbs.	35 lbs.	30 lbs.	25 lbs.	20½ lbs.
10	17.50	15.93	14.36	12.80	11.38
11	15.91	14.49	13.06	11.64	10.35
12	14.59	13.28	11.97	10.67	9.48
13	13.46	12.25	11.05	9.85	8.76
14	12.50	11.38	10.26	9.14	8.13
15	11.67	10.62	9.58	8.53	7.59
16	10.94	9.96	8.98	8.00	7.12
17	10.30	9.37	8.45	7.53	6.69
18	9.72	8.85	7.98	7.11	6.33
19	9.21	8.39	7.56	6.74	5.99
20	8.75	7.97	7.18	6.40	5.69
21	8.34	7.59	6.84	6.09	5.42
22	7.96	7.24	6.53	5.82	5.18
23	7.61	6.93	6.25	5.56	4.95
24	7.29	6.64	5.99	5.33	4.74
25	7.00	6.37	5.75	5.12	4.55
26	6.73	6.13	5.53	4.92	4.38
27	6.48	5.90	5.32	4.74	4.22
28	6.25	5.69	5.13	4.57	4.07
29	6.04	5.49	4.95	4.41	3.92
30	5.83	5.31	4.79	4.27	3.79

Safe load includes weight of Channel. Maximum fiber strain of 16,000 lbs. per square inch.

SAFE LOADS, UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, STEEL BEAMS.

IN TONS OF 2,000 LBS.

Distance in feet between supports.	15 Inch Beam, Heavy Section.				
	100 lbs.	95 lbs.	90 lbs.	85 lbs.	80 lbs.
10	63.96	62.00	60.04	58.08	56.11
11	58.14	56.36	54.58	52.80	51.01
12	53.30	51.66	50.03	48.40	46.76
13	49.20	47.69	46.18	44.67	43.17
14	45.68	44.28	42.88	41.48	40.08
15	42.64	41.33	40.02	38.72	37.41
16	39.97	38.75	37.52	36.30	35.07
17	37.62	36.47	35.32	34.16	33.01
18	35.53	34.44	33.35	32.26	31.17
19	33.66	32.63	31.60	30.57	29.52
20	31.98	31.00	30.02	29.04	28.06
21	30.45	29.52	28.59	27.66	26.73
22	29.07	28.18	27.29	26.40	25.51
23	27.81	26.96	26.10	25.25	24.40
24	26.65	25.83	25.01	24.20	23.38
25	25.58	24.80	24.01	23.23	22.45
26	24.60	23.84	23.09	22.34	21.58
27	23.69	22.96	22.24	21.51	20.78
28	22.84	22.14	21.44	20.74	20.04
29	22.05	21.38	20.70	20.03	19.35
30	21.32	20.67	20.01	19.36	18.70
31	20.63	20.00	19.37	18.73	18.10
32	19.99	19.37	18.76	18.15	17.54
33	19.38	18.79	18.19	17.60	17.00
34	18.81	18.23	17.66	17.08	16.50
35	18.27	17.71	17.15	16.59	16.03
36	17.76	17.22	16.68	16.13	15.59

Safe load includes weight of Beam. Maximum fiber strain of 16,000 lbs. per square inch.

SAFE LOADS, UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, STEEL BEAMS.

IN TONS OF 2,000 LBS.

Distance in feet between supports.	15 Inch Beam, Light Section.				
	80 lbs.	75 lbs.	70 lbs.	65 lbs.	60 lbs.
10	51.15	49.19	47.23	45.27	43.31
11	46.50	44.72	42.93	41.15	39.37
12	42.62	40.99	39.36	37.72	36.09
13	39.35	37.84	36.33	34.82	33.31
14	36.54	35.13	33.73	32.33	30.93
15	34.10	32.79	31.49	30.18	28.87
16	31.97	30.74	29.52	28.29	27.07
17	30.09	28.93	27.78	26.63	25.47
18	28.42	27.33	26.24	25.15	24.06
19	26.92	25.89	24.86	23.82	22.79
20	25.57	24.59	23.61	22.63	21.65
21	24.36	23.42	22.49	21.56	20.62
22	23.25	22.36	21.47	20.58	19.69
23	22.24	21.39	20.53	19.68	18.83
24	21.31	20.50	19.68	18.86	18.04
25	20.46	19.68	18.89	18.11	17.32
26	19.67	18.92	18.16	17.41	16.66
27	18.95	18.22	17.49	16.77	16.04
28	18.27	17.57	16.87	16.17	15.47
29	17.64	16.96	16.29	15.61	14.93
30	17.05	16.40	15.74	15.09	14.44
31	16.50	15.87	15.23	14.60	13.97
32	15.98	15.37	14.76	14.14	13.53
33	15.50	14.91	14.31	13.72	13.12
34	15.04	14.47	13.89	13.31	12.74
35	14.61	14.05	13.49	12.93	12.36
36	14.21	13.66	13.12	12.57	12.03

Safe load includes weight of Beam. Maximum fiber strain of 16,000 lbs. per square inch.

SAFE LOADS, UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, STEEL BEAMS.

IN TONS OF 2,000 LBS.

Distance in feet between supports.	15 Inch Beam, Standard.				
	60 lbs.	55 lbs.	50 lbs.	45 lbs.	42 lbs.
10	38.47	36.52	34.55	32.59	31.41
11	34.97	33.19	31.41	29.63	28.56
12	32.06	30.42	28.79	27.16	26.18
13	29.59	28.08	26.58	25.07	24.16
14	27.48	26.08	24.68	23.28	22.44
15	25.65	24.34	23.03	21.73	20.94
16	24.04	22.82	21.59	20.37	19.63
17	22.63	21.49	20.32	19.17	18.48
18	21.37	20.28	19.19	18.10	17.45
19	20.25	19.21	18.18	17.15	16.53
20	19.23	18.26	17.26	16.29	15.71
21	18.32	17.38	16.45	15.52	14.96
22	17.49	16.59	15.70	14.81	14.28
23	16.73	15.87	15.02	14.17	13.66
24	16.03	15.21	14.40	13.58	13.09
25	15.39	14.60	13.82	13.04	12.56
26	14.80	14.04	13.29	12.53	12.08
27	14.24	13.52	12.80	12.07	11.63
28	13.74	13.04	12.34	11.64	11.22
29	13.26	12.59	11.91	11.24	10.83
30	12.82	12.17	11.52	10.86	10.47
31	12.41	11.78	11.14	10.51	10.13
32	12.02	11.41	10.80	10.18	9.82
33	11.66	11.06	10.47	9.88	9.52
34	11.31	10.74	10.16	9.58	9.24
35	10.99	10.43	9.87	9.31	8.97
36	10.69	10.14	9.60	9.05	8.73

Safe load includes weight of Beam. Maximum fiber strain of 16,000 lbs. per square inch.

SAFE LOADS, UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, STEEL BEAMS.

IN TONS OF 2,000 LBS.

Distance in feet between supports.	12 Inch Beam, Special Section.				12 Inch Beam, Standard.		
	55 lbs.	50 lbs.	45 lbs.	40 lbs.	40 lbs.	35 lbs.	31½ lbs.
10	28.61	27.04	25.48	23.91	21.85	20.28	19.18
11	26.01	24.58	23.16	21.73	19.86	18.44	17.44
12	23.84	22.54	21.23	19.92	18.21	16.90	15.99
13	22.01	20.80	19.60	18.39	16.81	15.60	14.76
14	20.44	19.32	18.20	17.08	15.62	14.49	13.70
15	19.08	18.03	16.98	15.94	14.56	13.52	12.79
16	17.88	16.90	15.92	14.94	13.66	12.68	11.99
17	16.83	15.91	14.99	14.06	12.85	11.93	11.28
18	15.90	15.02	14.15	13.28	12.14	11.27	10.66
19	15.06	14.23	13.41	12.58	11.50	10.62	10.10
20	14.31	13.52	12.74	11.95	10.93	10.14	9.59
21	13.63	12.88	12.13	11.38	10.41	9.66	9.14
22	13.01	12.29	11.58	10.87	9.93	9.22	8.72
23	12.44	11.76	11.08	10.39	9.50	8.82	8.34
24	11.92	11.27	10.61	9.96	9.10	8.45	7.99
25	11.45	10.82	10.19	9.56	8.75	8.11	7.67
26	11.01	10.40	9.80	9.19	8.40	7.80	7.38
27	10.60	10.02	9.43	8.85	8.09	7.51	7.10
28	10.22	9.66	9.10	8.54	7.81	7.24	6.85
29	9.87	9.33	8.78	8.24	7.53	6.99	6.62
30	9.54	9.01	8.48	7.97	7.28	6.76	6.39
31	9.23	8.72	8.21	7.71	7.05	6.54	6.19
32	8.94	8.45	7.96	7.47	6.83	6.34	5.99
33	8.67	8.19	7.72	7.24	6.62	6.15	5.81
34	8.42	7.95	7.49	7.03	6.43	5.97	5.64
35	8.17	7.72	7.28	6.83	6.24	5.79	5.48
36	7.95	7.51	7.08	6.64	6.07	5.63	5.33

Safe load includes weight of Beam. Maximum fiber strain of 16,000 lbs. per square inch.

SAFE LOADS, UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, STEEL CHANNELS.

IN TONS OF 2,000 LBS.

Distance in feet between supports.	6 Inch Channel, Standard.				5 Inch Channel, Standard.		
	15½ lbs.	13 lbs.	10½ lbs.	8 lbs.	11½ lbs.	9 lbs.	6½ lbs.
5	6.97	6.19	5.41	4.62	4.47	3.82	3.16
6	5.81	5.16	4.50	3.85	3.73	3.18	2.64
7	4.98	4.42	3.86	3.30	3.19	2.73	2.26
8	4.36	3.87	3.38	2.89	2.79	2.39	1.98
9	3.87	3.44	3.00	2.57	2.48	2.12	1.76
10	3.49	3.09	2.73	2.31	2.23	1.92	1.58
11	3.17	2.81	2.45	2.10	2.03	1.75	1.44
12	2.91	2.58	2.25	1.93	1.86	1.59	1.32
13	2.68	2.38	2.08	1.78	1.72	1.48	1.22
14	2.49	2.21	1.93	1.65	1.59	1.36	1.13
15	2.32	2.06	1.80	1.54	1.49	1.27	1.05
16	2.18	1.93	1.69	1.44	1.39	1.19	.99
17	2.05	1.82	1.59	1.36	1.31	1.13	.93
18	1.93	1.72	1.50	1.28	1.24	1.06	.88
19	1.84	1.62	1.42	1.22	1.17	1.01	.83
20	1.74	1.55	1.35	1.15	1.11	.96	.79
21	1.66	1.47	1.29	1.10	1.06	.91	.75
22	1.58	1.40	1.22	1.05	1.01	.87	.72
23	1.52	1.35	1.17	1.00	.97	.83	.69
24	1.45	1.29	1.12	.96	.93	.79	.66
25	1.39	1.24	1.08	.92	.89	.76	.63

Safe load includes weight of Channel. Maximum fiber strain of 16,000 lbs. per square inch.

SAFE LOADS, UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, STEEL CHANNELS.

IN TONS OF 2,000 LBS.

Distance in feet between supports.	4 Inch Channel, Standard.			3 Inch Channel, Standard.		
	7¼ lbs.	6¼ lbs.	5¼ lbs.	6 lbs.	5 lbs.	4 lbs.
5	2.44	2.23	2.02	1.48	1.32	1.16
6	2.04	1.86	1.69	1.23	1.10	.97
7	1.74	1.59	1.44	1.06	.94	.83
8	1.53	1.39	1.26	.92	.82	.73
9	1.36	1.24	1.12	.82	.73	.65
10	1.22	1.12	1.01	.74	.66	.58
11	1.11	1.01	.92	.67	.60	.53
12	1.02	.93	.84	.62	.55	.48
13	.94	.86	.78	.57	.51	.45
14	.87	.79	.76	.53	.47	.41
15	.81	.74	.67	.49	.44	.39
16	.76	.69	.63	.46	.41	.36
17	.72	.66	.60	.43	.39	.34
18	.68	.62	.56	.41	.36	.32
19	.64	.59	.53	.39	.35	.31
20	.62	.56	.51	.37	.33	.29
21	.58	.53	.49	.35	.31	.28
22	.55	.50	.46	.33	.30	.26
23	.53	.48	.44	.32	.29	.25
24	.51	.46	.42	.31	.27	.24
25	.49	.45	.40	.29	.26	.23

Safe load includes weight of Channel. Maximum fiber strain of 16,000 lbs. per square inch.

TEES.

SAFE LOADS, IN TONS OF 2,000 LBS., UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, TEES.

Section No.	Size flange by stem.	Distance between Supports in Feet.									
		1	2	3	4	5	6	7	8	9	10
T 20	4 ×5	13.40	6.70	4.47	3.35	2.68	2.23	1.91	1.68	1.49	1.34
T 21	4 ×4¼	12.22	6.11	4.07	3.06	2.44	2.04	1.75	1.53	1.36	1.22
T 22	4 ×4½	11.08	5.51	3.67	2.76	2.20	1.84	1.57	1.38	1.22	1.10
T 1	4 ×4	8.75	4.37	2.92	2.19	1.75	1.46	1.25	1.09	0.97	0.88
T 2	4 ×4	7.71	3.86	2.57	1.93	1.54	1.29	1.10	0.96	0.86	0.77
T 3	3½×3½	5.53	2.77	1.84	1.38	1.11	0.92	0.79	0.69	0.61	0.55
T 4	3½×3½	4.79	2.39	1.60	1.20	0.96	0.80	0.69	0.60	0 53	0.48
T 23	3½×3	4.09	2.04	1.36	1.02	0.82	0.68	0.58	0.51	0.45	0.41
T 24	3½×3	3.54	1.77	1.18	0.88	0.71	0.59	0.51	0.44	0.39	0.35
T 26	3 ×3½	5.39	2.69	1.80	1.35	1.08	0.90	0.77	0.67	0.60	0.54
T 25	3 ×3½	4.67	2.33	1.56	1.17	0.93	0.78	0.67	0.58	0.52	0.47
T 5	3 ×3	3.58	1.79	1.19	0.90	0.72	0.60	0.51	0.45	0.40	0.36
T 6	3 ×3	3.08	1.54	1.03	0.77	0.62	0.51	0.44	0.38	0.34	0.31
T 7	2½×2¼	2.44	1.22	0.81	0.61	0.49	0.41	0.35	0.30	0.27	0.24
T 8	2½×2½	2.09	1.04	0.70	0.52	0.42	0.35	0.30	0.26	0.23	0.21
T 28	2½×2	1.27	0.64	0.42	0.32	0.25	0.21	0.18	0.16	0.14	0.13
T 9	2¼×2¼	1.60	0.80	0.53	0.40	0.32	0.27	0.23	0.20	0.18	0.16
T 10	2¼×2¼	1.31	0.65	0.44	0.33	0.26	0.22	0.19	0.16	0.15	0.13
T 11	2 ×2	1.02	0.51	0.34	0.26	0.20	0.17	0.15	0.13	0.11	0.10
T 27	2½×1¾	0.77	0.39	0.26	0.19	0.15	0.13	0.11	0.10	0.09	0.08
T 13	1¾×1¾	0.77	0.38	0.26	0.19	0.15	0.13	0.11	0.10	0.09	0.08
T 12	1¾×1¾	0.51	0.26	0.17	0.13	0.10	0.09	0.07	0.06	0.06	0.05
T 14	1½×1½	0.55	0.28	0.18	0.14	0.11	0.09	0.08	0.07	0.06	0.06
T 15	1½×1½	0.46	0.23	0.15	0.11	0.09	0.08	0.07	0.06	0.05	0.05
T 16	1¼×1¼	0.39	0.20	0.13	0.10	0.08	0.07	0.06	0.05	0.04	0.04
T 17	1¼×1¼	0.29	0.15	0.10	0.07	0.06	0.05	0.04	0.04	0.03	0.03
T 18	1 ×1	0.19	0.10	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02
T 19	1 ×1	0.14	0.07	0.05	0.03	0.03	0.02	0.02	0.02	0.02	0.01

Safe Loads include weight of Tees. Maximum fiber strain, 12,000 lbs. per square inch.

ANGLES.

SAFE LOADS, IN TONS OF 2,000 LBS., UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, ANGLES, WITH EQUAL LEGS.

Size of Angle.	Distance between Supports in Feet.									
	1	2	3	4	5	6	7	8	9	10
6 ×6 ×7/16	16.28	8.14	5.43	4.07	3.26	2.72	2.33	2.04	1.81	1.63
6 ×6 ×⅜	30.56	15.28	10.19	7.64	6.11	5.09	4.37	3.82	3.40	3.06
5 ×5 ×11/16	8.88	4.44	2.96	2.22	1.78	1.48	1.27	1.11	0.99	0.89
5 ×5 ×¾	18.08	9.04	6.03	4.52	3.62	3.01	2.58	2.26	2.01	1.81
4 ×4 ×5/16	6.08	3.04	2.03	1.52	1.22	1.01	0.87	0.76	0.68	0.61
4 ×4 ×¾	11.24	5.62	3.75	2.81	2.25	1.87	1.61	1.41	1.25	1.12
3½×3½×5/16	4.60	2.30	1.53	1.15	0.92	0.77	0.66	0.58	0.51	0.46
3½×3½×¾	8.12	4.06	2.71	2.03	1.62	1.35	1.16	1.02	0.90	0.81
3¼×3¼×5/16	3.96	1.98	1.32	0.99	0.79	0.66	0.57	0.50	0.44	0.40
3¼×3¼×¾	5.44	2.72	1.81	1.36	1.09	0.91	0.78	0.68	0.60	0.54
3 ×3 ×⅛	2.32	1.16	0.77	0.58	0.46	0.39	0.33	0.29	0.26	0.23
3 ×3 ×5/16	5.20	2.60	1.73	1.30	1.04	0.87	0.74	0.65	0.58	0.52
2¾×2¾×¼	1.92	0.96	0.64	0.48	0.38	0.32	0.28	0.24	0.21	0.19
2¾×2¾×⅜	3.56	1.78	1.18	0.89	0.71	0.58	0.51	0.45	0.40	0.36
2½×2½×¼	1.60	0.80	0.53	0.40	0.32	0.27	0.23	0.20	0.18	0.16
2½×2½×⅜	2.92	1.46	0.97	0.73	0.58	0.49	0.42	0.37	0.32	0.29
2¼×2¼×¼	1.28	0.64	0.43	0.32	0.26	0.21	0.18	0.16	0.14	0.13
2¼×2¼×⅜	2.32	1.16	0.77	0.58	0.46	0.39	0.33	0.29	0.26	0.23
2 ×2 ×⅛	0.60	0.30	0.20	0.15	0.12	0.10	0.09	0.08	0.07	0.06
2 ×2 ×5/16	1.60	0.80	0.53	0.40	0.32	0.27	0.23	0.20	0.18	0.16
1¾×1¾×1/8	0.44	0.22	0.15	0.11	0.09	0.07	0.06	0.06	0.05	0.04
1¾×1¾×5/16	1.20	0.60	0.40	0.30	0.24	0.20	0.17	0.15	0.13	0.12
1½×1½×⅛	0.31	0.16	0.10	0.08	0.06	0.05	0.04	0.04	0.03	0.03
1½×1½×⅜	0.77	0.39	0.26	0.19	0.15	0.13	0.11	0.10	0.09	0.08
1¼×1¼×⅛	0.20	0.098	0.065	0.049	0.039	0.033	0.028	0.024	0.022	0.020
1¼×1¼×¼	0.36	0.18	0.12	0.09	0.072	0.060	0.051	0.045	0.040	0.036
1 ×1 ×⅛	0.13	0.065	0.043	0.033	0.026	0.022	0.019	0.016	0.014	0.013
1 ×1 ×¼	0.17	0.085	0.057	0.043	0.034	0.028	0.024	0.021	0.019	0.017
¾× ¾×⅛	0.07	0.035	0.023	0.018	0.014	0.012	0.010	0.009	0.008	0.007
¾× ¾×¼	0.095	0.048	0.032	0.024	0.019	0.016	0.014	0.012	0.011	0.010

Safe Loads include weight of Angle. Maximum fiber strain 12,000 lbs. per square inch. Neutral axis through center of gravity parallel to one leg.

ANGLES.

SAFE LOADS, IN TONS OF 2,000 LBS., UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, ANGLES, WITH UNEQUAL LEGS.

LONG LEG VERTICAL.

Size of Angle.	Distance between Supports in Feet.									
	1	2	3	4	5	6	7	8	9	10
6 ×4 × 5/8	13.28	6.64	4.43	3.32	2.66	2.21	1.90	1.66	1.47	1.33
6 ×4 × 1/2	26 60	13.30	8.87	6.65	5.32	4.43	3.80	3.33	2.96	2.66
6 ×3½× 5/8	13.00	6.50	4.33	3.25	2.60	2.17	1.86	1.63	1.44	1.30
6 ×3½× 1/2	24.80	12.40	8.27	6.20	4.96	4.13	3.54	3.10	2.76	2.48
5 ×4 × 5/8	9.40	4.70	3.13	2.35	1.88	1.57	1.34	1.18	1.04	0.94
5 ×4 × 3/4	17.24	8.62	5.75	4.31	3.45	2.87	2.46	2.16	1.92	1.72
5 ×3½× 5/8	9.16	4.58	3.05	2.29	1.83	1.53	1.31	1.15	1.02	0.92
5 ×3½× 3/4	16.88	8.44	5.63	4.22	3.38	2.81	2.41	2.11	1.88	1.69
5 ×3 × 5/8	8.92	4.46	2.97	2.23	1.78	1.49	1.27	1.12	0.99	0.89
5 ×3 × 3/4	16.52	8.26	5.51	4.13	3.30	2.75	2.36	2.07	1.84	1.65
4 ×3½× 5/8	6.00	3.00	2.00	1.50	1.20	1.00	0.86	0.75	0.67	0.60
4 ×3½× 3/4	10.92	5.46	3.64	2.73	2.18	1.82	1.56	1.37	1.21	1.09
4 ×3 × 5/8	5.72	2.86	1.91	1.43	1.14	0.95	0.82	0.72	0.64	0.57
4 ×3 × 3/4	10.64	5.32	3.55	2.66	2.13	1.77	1.52	1.33	1.18	1.06
3½×2½× 5/8	5.04	2.52	1.68	1.26	1.01	0.84	0.72	0.63	0.56	0.50
3½×2½× 3/4	9.16	4.58	3.05	2.29	1.83	1.53	1.31	1.15	1.02	0.92
3½×3 × 5/8	4.86	2.18	1.45	1.09	0.87	0.73	0.62	0.55	0.48	0.44
3½×3 × 3/4	8.12	4.06	2.71	2.03	1.62	1.35	1.16	1.02	0.90	0.81
3½×2½× 1/2	3.00	1.50	1.00	0.75	0.60	0.50	0.43	0.38	0.33	0.30
3½×2½× 1/2	5.84	2.92	1.95	1.46	1.17	0.97	0.83	0.73	0.65	0.58
3 ×2½× 1/4	2.24	1.12	0.75	0.56	0.45	0.37	0.32	0.28	0.25	0.22
3 ×2½× 1/2	4.12	2.06	1.37	1.03	0.82	0.69	0.59	0.52	0.46	0.41
3¼×2 × 1/4	2.04	1.02	0.68	0.51	0.41	0.34	0.29	0.26	0.23	0.20
3¼×2 × 1/2	4.64	2.32	1.55	1.16	0.93	0.77	0.66	0.58	0.52	0.46
3 ×2 × 3/16	3.36	1.68	1.12	0.84	0.67	0.56	0.48	0.42	0.37	0.34
3 ×2 × 1/2	4.00	2.00	1.33	1.00	0.80	0.67	0.57	0.50	0.44	0.40
2½×2 × 3/16	1.16	0.58	0.39	0.29	0.23	0.19	0.17	0.15	0.13	0.12
2½×2 × 1/2	2.84	1.42	0.95	0.71	0.57	0.47	0.41	0.36	0.32	0.28
1¾×1½× 3/16	0.84	0.42	0.28	0.21	0.17	0.14	0.12	0.11	0.09	0.08
1⅜× ⅞× 1/8	0.28	0.12	0.08	0.06	0.05	0.04	0.03	0.03	0.03	0.02
1 × ⅝× 1/8	0.11	0.06	0.04	0.03	0.02	0.02	0.02	0.01	0.01	0.01

Safe Loads include weight of Angle. Maximum fiber strain of 12,000 lbs. per square inch. Neutral axis through centre of gravity parallel to short leg.

ANGLES.

SAFE LOADS, IN TONS OF 2,000 LBS., UNIFORMLY DISTRIBUTED, FOR JONES & LAUGHLINS, LIMITED, ANGLES, WITH UNEQUAL LEGS.

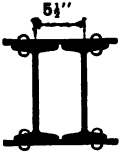
SHORT LEG VERTICAL.

Size of Angle.	Distance between Supports in Feet.									
	1	2	3	4	5	6	7	8	9	10
6 ×4 ×⅜	6.40	3.20	2.13	1.60	1.28	1.07	0.91	0.80	0.71	0.64
6 ×4 ×13/16	12.60	6.30	4.20	3.15	2.52	2.10	1.80	1.58	1.40	1.26
6 ×3½×⅜	4.92	2.46	1.64	1.23	0.98	0.82	0.70	0.62	0.55	0.49
6 ×3½×13/16	9.64	4.82	3.21	2.41	1.93	1.61	1.38	1.21	1.07	0.96
5 ×4 ×⅜	6.28	3.14	2.09	1.57	1.26	1.05	0.90	0.79	0.70	0.63
5 ×4 ×¾	11.44	5.72	3.81	2.86	2.29	1.91	1.63	1.43	1.27	1.14
5 ×3½×⅜	4.80	2.40	1.60	1.20	0.96	0.80	0.69	0.60	0.53	0.48
5 ×3½×¾	8.72	4.36	2.91	2.18	1.74	1.45	1.25	1.09	0.97	0.87
5 ×3 ×⅜	3.56	1.78	1.19	0.89	0.71	0.59	0.51	0.45	0.40	0.36
5 ×3 ×¾	6.44	3.22	2.15	1.61	1.29	1.07	0.92	0.81	0.72	0.64
4 ×3½×⅜	4.72	2.36	1.57	1.18	0.94	0.79	0.67	0.59	0.52	0.47
4 ×3½×¾	8.52	4.26	2.84	2.13	1.70	1.42	1.22	1.07	0.95	0.85
4 ×3 ×⅜	3.40	1.70	1.13	0.85	0.68	0.57	0.49	0.43	0.38	0.34
4 ×3 ×¾	6.24	3.12	2.08	1.56	1.25	1.04	0.89	0.78	0.69	0.62
3½×2½×⅜	2.64	1.32	0.88	0.66	0.53	0.44	0.38	0.33	0.29	0.26
3½×2½×¾	4.72	2.36	1.57	1.18	0.94	0.79	0.67	0.59	0.52	0.47
3½×3 ×⅜	3.32	1.66	1.11	0.83	0.66	0.55	0.47	0.42	0.37	0.33
3½×3 ×¾	6.08	3.04	2.03	1.52	1.22	1.01	0.87	0.76	0.68	0.61
3½×2½×¼	1.64	0.82	0.55	0.41	0.33	0.27	0.23	0.21	0.18	0.16
3½×2½×½	3.24	1.62	1.08	0.81	0.65	0.54	0.46	0.41	0.36	0.32
3 ×2½×¼	1.60	0.80	0.53	0.40	0.32	0.27	0.23	0.20	0.18	0.16
3 ×2½×½	2.92	1.46	0.97	0.73	0.58	0.49	0.42	0.37	0.32	0.29
3¼×2 ×¼	0.84	0.42	0.28	0.21	0.17	0.14	0.12	0.11	0.09	0.08
3¼×2 ×½	1.92	0.96	0.64	0.48	0.38	0.32	0.27	0.24	0.21	0.19
3 ×2 ×3/16	0.80	0.40	0.27	0.20	0.16	0.13	0.11	0.10	0.09	0.08
3 ×2 ×½	1.88	0.94	0.63	0.47	0.38	0.31	0.27	0.24	0.21	0.19
2½×2 ×3/16	0.76	0.38	0.25	0.19	0.15	0.13	0.11	0.10	0.08	0.08
2½×2 ×½	1.87	0.94	0.62	0.47	0.37	0.31	0.27	0.23	0.21	0.19
1¾×1⅛×⅛	0.37	0.19	0.12	0.09	0.07	0.06	0.05	0.05	0.04	0.04
1⅝× ⅝×⅛	0.10	0.05	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01
1 × ⅝×⅛	0.048	0.024	0.016	0.012	0.010	0.008	0.007	0.006	0.005	0.005

Safe Loads include weight of Angle. Maximum fiber strain of 12,000 lbs. per square inch. Neutral axis through centre of gravity parallel to long leg.

GIRDERS.

SAFE LOAD, IN TONS OF 2,000 LBS. UNIFORMLY DISTRIBUTED, FOR BOX GIRDERS COMPOSED OF TWO 10" BEAMS AND TWO 12X½" PLATES.



2-10" Beams. 25 lbs. per foot.

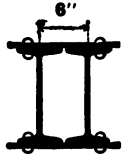
2-12x½" Steel Plates.

Distance, center to center of bearings, in feet.	Safe Load in Tons, including weight of Girder.	Weight of Girder in pounds.	Add to Safe Load for 5 pounds increase in weight of Beam.	Add to Safe Load for ¼" increase in thickness of Plates.	Add to weight of Girder for 5 pounds increase in weight of Beam.	Add to weight of Girder for ¼" increase in thickness of plates.
12	32.5	1114	1.56	2.35	120	61
13	30.0	1206	1.44	2.17	130	66
14	27.9	1299	1.34	2.01	140	71
15	26.0	1392	1.25	1.88	150	77
16	24.4	1485	1.17	1.76	160	82
17	22.9	1578	1.10	1.66	170	87
18	21.7	1670	1.04	1.57	180	92
19	20.5	1763	0.98	1.48	190	97
20	19.5	1856	0.93	1.41	200	102
21	18.6	1949	0.89	1.34	210	107
22	17.8	2042	0.85	1.28	220	112
23	17.0	2134	0.81	1.23	230	117
24	16.3	2227	0.78	1.17	240	122
25	15.6	2320	0.75	1.13	250	128
26	15.0	2413	0.72	1.08	260	133
27	14.4	2506	0.69	1.04	270	138
28	13.9	2598	0.67	1.01	280	143
29	13.4	2691	0.64	0.97	290	148
30	13.0	2784	0.62	0.94	300	153
31	12.6	2877	0.60	0.91	310	158
32	12.2	2970	0.58	0.88	320	163
33	11.8	3062	0.57	0.85	330	168
34	11.5	3155	0.55	0.83	340	173
35	11.1	3248	0.53	0.81	350	179
36	10.8	3341	0.52	0.78	360	184
37	10.5	3434	0.51	0.76	370	189
38	10.3	3526	0.49	0.74	380	194

Above values are based on maximum fiber strain of 13,000 lbs. per square inch, ⅞" rivet holes deducted. Weights correspond to lengths, center to center of bearings.

GIRDERS.

SAFE LOAD, IN TONS OF 2,000 LBS. UNIFORMLY DISTRIBUTED, FOR BOX GIRDER COMPOSED OF TWO 12" STEEL BEAMS AND TWO 14X¾" STEEL PLATES.

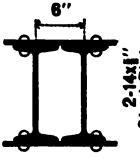
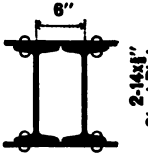


Distance, center to center of bearings, in feet.	2-12" Beams. 31½ lbs. per foot. 2-14x¾" Steel Plates.			2-12" Beams. 40 lbs. per foot. 2-14x¾" Steel Plates.			
	Safe Load in Tons, including weight of Girder.	Weight of Girder in pounds.	Add to Safe Load for 1 pound increase in weight of Beam.	Safe Load in Tons, including weight of Girder.	Weight of Girder in pounds.	Add to Safe Load for 5 pounds increase in weight of Beam.	Add to Safe Load for ¼" increase in thickness of Plates.	Add to weight of Girder for ¼" increase in thickness of flange plates.
12	47.7	1351	0.395	53.0	1555	1.94	3.36	71
13	44.0	1464	0.364	48.9	1685	1.79	3.10	77
14	40.9	1576	0.338	45.4	1814	1.66	2.88	83
15	38.1	1689	0.316	42.4	1944	1.55	2.69	89
16	35.7	1802	0.296	39.7	2074	1.45	2.52	95
17	33.6	1914	0.279	37.4	2203	1.37	2.37	101
18	31.8	2027	0.263	35.3	2333	1.29	2.24	107
19	30.1	2139	0.249	33.5	2462	1.22	2.12	113
20	28.6	2252	0.237	31.8	2592	1.16	2.02	119
21	27.2	2365	0.225	30.3	2722	1.11	1.92	125
22	26.0	2477	0.215	28.9	2851	1.06	1.83	131
23	24.9	2590	0.206	27.6	2981	1.01	1.75	137
24	23.8	2702	0.197	26.5	3110	0.97	1.68	143
25	22.9	2815	0.189	25.4	3240	0.93	1.61	149
26	22.0	2928	0.182	24.4	3370	0.89	1.55	155
27	21.2	3040	0.175	23.5	3499	0.86	1.49	161
28	20.4	3153	0.169	22.7	3629	0.83	1.44	167
29	19.7	3265	0.163	21.9	3758	0.80	1.39	173
30	19.1	3378	0.158	21.2	3888	0.77	1.34	179
31	18.4	3491	0.153	20.5	4018	0.75	1.30	184
32	17.8	3603	0.148	19.9	4147	0.73	1.26	190
33	17.3	3716	0.143	19.3	4277	0.70	1.22	196
34	16.8	3828	0.139	18.7	4406	0.68	1.19	202
35	16.3	3941	0.135	18.2	4536	0.66	1.15	208
36	15.9	4054	0.131	17.7	4666	0.65	1.12	214
37	15.4	4166	0.128	17.2	4795	0.63	1.09	220
38	15.0	4279	0.124	16.7	4925	0.61	1.06	226

Above values are based on maximum fiber strain of 13,000 lbs. per square inch, ⅞" rivet holes deducted. Weights correspond to length, center to center of bearings.

GIRDERS.

SAFE LOAD, IN TONS OF 2,000 LBS., UNIFORMLY DISTRIBUTED, FOR BOX GIRDER COMPOSED OF TWO 15" STEEL BEAMS AND TWO 14X½" STEEL PLATES.

Distance, center to center of bearings, in feet.	2-15" Beams, 42 lbs. per foot.  2-14x½" Steel Plates.			2-15" Beams, 60 lbs. per foot.  2-14x½" Steel Plates.				
	Safe Load in Tons, Including weight of Girder.	Weight of Girder in pounds.	Add to Safe Load for 1 pound increase in weight of Beam.	Safe Load in Tons, Including weight of Girder.	Weight of Girder in pounds.	Add to Safe Load for 5 pounds increase in weight of Beam.	Add to Safe Load for ¼" increase in thickness of Plates.	Add to weight of Girder for ¼" increase in thickness of flange plates.
12	76.6	1746	0.486	90.2	2178	2.47	4.20	72
13	70.7	1891	0.449	83.2	2359	2.28	3.87	78
14	65.7	2037	0.417	77.3	2541	2.11	3.60	84
15	61.3	2182	0.389	72.1	2722	1.97	3.36	90
16	57.5	2328	0.365	67.6	2904	1.85	3.15	96
17	54.1	2473	0.343	63.6	3085	1.74	2.96	102
18	51.1	2619	0.324	60.1	3267	1.64	2.80	108
19	48.4	2764	0.307	56.9	3448	1.56	2.65	114
20	46.0	2910	0.292	54.1	3630	1.48	2.52	120
21	43.8	3055	0.278	51.5	3811	1.41	2.40	126
22	41.8	3201	0.265	49.2	3993	1.34	2.29	132
23	40.0	3346	0.253	47.0	4174	1.29	2.19	138
24	38.3	3492	0.243	45.1	4356	1.23	2.10	144
25	36.8	3637	0.233	43.3	4537	1.18	2.01	150
26	35.4	3783	0.224	41.6	4719	1.14	1.94	156
27	34.1	3928	0.216	40.1	4900	1.10	1.86	162
28	32.8	4074	0.208	38.6	5082	1.06	1.80	168
29	31.7	4219	0.201	37.3	5263	1.02	1.74	174
30	30.7	4365	0.195	36.1	5445	0.99	1.68	180
31	29.7	4510	0.189	34.9	5626	0.95	1.62	186
32	28.7	4656	0.182	33.8	5808	0.92	1.57	192
33	27.9	4801	0.177	32.8	5989	0.90	1.52	198
34	27.0	4947	0.172	31.8	6171	0.87	1.48	204
35	26.3	5092	0.167	30.9	6352	0.84	1.44	210
36	25.5	5238	0.162	30.0	6534	0.82	1.40	216
37	24.9	5383	0.158	29.2	6715	0.80	1.36	222
38	24.2	5529	0.154	28.5	6897	0.78	1.33	228

Above values are based on maximum fiber strain of 13,000 lbs. per square inch, $\frac{1}{16}$" rivet holes deducted. Weights correspond to lengths, center to center of bearings.

GIRDERS.

SAFE LOAD, IN TONS OF 2,000 LBS., UNIFORMLY DISTRIBUTED, FOR BOX GIRDER COMPOSED OF TWO 20" STEEL BEAMS AND TWO 16X½" STEEL PLATES.

Distance, center to center of bearings, in feet.	2-20" Steel Beams. 60 lbs. per foot. 7½" 2-16x½" Steel Plates.				2-20" Steel Beams. 64 lbs. per foot. 7" 2-16x½" Steel Plates.				
	Safe Load in Tons, including weight of Girder.	Weight of Girder in pounds.	Add to Safe Load for 5 pounds increase in weight of Beam.	Add to Safe Load for ¼" increase in thickness of Plates.	Safe Load in Tons, including weight of Girder.	Weight of Girder in pounds.	Add to Safe Load for 1 pound increase in weight of Beam.	Add to Safe Load for ¼" increase in thickness of Plates.	Add to weight of Girder for ¼" increase in thickness of plates.
12	167.5	2923	3.24	6.02	148.7	2539	0.647	6.12	82
13	154.7	3167	2.99	5.56	137.3	2751	0.597	5.65	88
14	143.6	3410	2.78	5.16	127.5	2962	0.555	5.25	95
15	134.0	3654	2.59	4.81	119.0	3174	0.518	4.90	102
16	125.7	3898	2.43	4.51	111.5	3386	0.485	4.59	109
17	118.3	4141	2.28	4.25	105.0	3597	0.457	4.32	116
18	111.7	4385	2.16	4.01	99.1	3809	0.432	4.08	122
19	105.8	4628	2.05	3.80	93.9	4020	0.409	3.86	129
20	100.5	4872	1.94	3.61	89.2	4232	0.388	3.67	136
21	95.7	5116	1.85	3.44	85.0	4444	0.370	3.50	143
22	91.4	5359	1.77	3.28	81.1	4655	0.353	3.34	150
23	87.4	5603	1.69	3.14	77.6	4867	0.338	3.19	156
24	83.8	5846	1.62	3.01	74.4	5078	0.324	3.06	163
25	80.4	6090	1.55	2.89	71.4	5290	0.311	2.94	170
26	77.3	6334	1.50	2.78	68.6	5502	0.299	2.82	177
27	74.5	6577	1.44	2.68	66.1	5713	0.288	2.72	184
28	71.8	6821	1.39	2.58	63.7	5925	0.277	2.62	190
29	69.3	7064	1.34	2.49	61.5	6136	0.268	2.53	197
30	67.0	7308	1.30	2.41	59.5	6348	0.259	2.45	204
31	64.8	7552	1.25	2.33	57.6	6560	0.251	2.37	211
32	62.8	7795	1.21	2.26	55.8	6771	0.243	2.29	218
33	60.9	8039	1.18	2.19	54.1	6983	0.235	2.22	224
34	59.1	8282	1.14	2.12	52.5	7194	0.228	2.16	231
35	57.4	8526	1.11	2.06	51.0	7406	0.222	2.10	238
36	55.8	8770	1.08	2.01	49.6	7618	0.216	2.04	245
37	54.3	9013	1.05	1.95	48.2	7829	0.210	1.98	252
38	52.9	9256	1.03	1.90	47.0	8041	0.204	1.93	258

Above values are based on maximum fiber strain of 13,000 lbs. per square inch, ⅞" rivet holes deducted. Weights correspond to lengths, center to center of bearings.

STEEL PLATE GIRDERS.

SAFE LOAD IN POUNDS, UNIFORMLY DISTRIBUTED.

Clear Span in feet.	No. 1 G. 24 × ⅜ Web Plates. 6 ×3½×½ Flange Angles. 8 ×2½×⅜ Stiffener Angles. 2½× ½ Fillers.				No. 1 G. 24 × ⅜ Web Plates. 6 ×3½×$\frac{7}{16}$ Flange Angles. 8 ×2½×⅜ Stiffener Angles. 2½× $\frac{7}{16}$ Fillers.			
	Safe Load, including weight of Girder, for fiber strain of 16,000 lbs. per sq. in.	Safe Load, including weight of Girder, for fiber strain of 12,500 lbs. per sq. in.	Estimated weight of Girder.	Deflection.	Safe Load, including weight of Girder, for fiber strain of 16,000 lbs. per sq. in.	Safe Load, including weight of Girder, for fiber strain of 12,500 lbs. per sq. in.	Estimated weight of Girder.	Deflection.
14	143960	112065	1849	.....	115275	95775	1723	.....
15	134760	104860	1941	.....	115190	94730	1808	.....
16	126625	98480	2034	.....	114425	88965	1893	.....
17	119385	94720	2126	.....	107880	83840	1978	.....
18	112900	87720	2218	.....	102015	79235	2063	.....
19	107005	83085	2355	.....	96680	75050	2191	.....
20	101715	78925	2447	.278	91885	71275	2276	.278
21	96880	75130	2540	.305	87520	67840	2361	.305
22	92470	71660	2632	.333	83535	64705	2447	.333
23	88415	68475	2724	.363	79860	61880	2532	.363
24	84635	65495	2855	.398	76445	59125	2653	.394
25	81175	62775	2947	.426	73310	56660	2739	.426
26	77970	60250	3039	.460	70415	54375	2824	.459
27	74980	57890	3132	.494	67710	52250	2909	.494
28	72195	55695	3224	.530	65185	50265	2994	.530
29	69545	53595	3354	.567	62785	48365	3116	.567
30	67105	51675	3446	.606	60580	46620	3201	.605
31	64810	49850	3539	.645	58505	44975	3286	.645
32	62640	48140	3631	.686	56550	43430	3371	.686
33	60595	46525	3723	.728	54595	41965	3456	.728
34	58630	44970	3850	.772	52915	40545	3575	.772
35	56805	43515	3943	.817	51260	39240	3660	.816
36	55065	42145	4035	.863	49695	37995	3745	.862
37	53425	40885	4127	.910	48200	36810	3830	.909
38	51860	39590	4220	.959	46785	35685	3915	.958

The above values are found on the moments of inertia of the sections with a fiber strain of 16,000 lbs. and 12,500 lbs. respectively for steel; $\frac{1}{8}$" rivet holes deducted. Weights of girders include 12 inches of bearing at each end, stiffeners, fillers and rivet heads.

STEEL PLATE GIRDERS.

SAFE LOAD IN POUNDS, UNIFORMLY DISTRIBUTED.

Clear Span in feet.	No. 1 G. 24 × ⅜ Web Plates. 6 ×3½×⅜ Flange Angles. 3 ×2½×⅜ Stiffener Angles. 2½× ⅜ Fillers.				No. 2 G. 22 × ⅜ Web Plates. 5 ×3 ×½ Flange Angles. 3 ×2½×⅜ Stiffener Angles. 2½× ½ Fillers.			
	Safe Load, including weight of Girder, for fiber strain of 16,000 lbs. per sq. in.	Safe Load, including weight of Girder, for fiber strain of 12,500 lbs. per sq. in.	Estimated weight of Girder.	Deflection.	Safe Load, including weight of Girder, for fiber strain of 16,000 lbs. per sq. in.	Safe Load, including weight of Girder, for fiber strain of 12,500 lbs. per sq. in.	Estimated weight of Girder.	Deflection.
14	115400	89810	1598	.....	105630	85120	1618	.....
15	108015	84015	1676	.....	102400	79620	1698	.....
16	101495	78905	1753	.....	96200	74760	1778	.....
17	95670	74340	1831	.....	90685	70435	1857	.....
18	90460	70250	1909	.....	85725	66545	1937	.....
19	85720	66530	2029	.....	81225	62995	2054	.....
20	81465	63185	2107	.277	77185	59825	2134	.297
21	77595	60145	2184	.305	73495	56925	2214	.326
22	74040	57350	2262	.333	70125	54275	2294	.357
23	70790	54790	2340	.362	67025	51835	2373	.388
24	67745	52385	2454	.393	64130	49550	2490	.422
25	64970	50200	2532	.425	61490	47470	2570	.456
26	62390	48170	2609	.459	59040	45540	2650	.492
27	59995	46285	2687	.493	56750	43740	2730	.529
28	57755	44515	2765	.529	54630	42050	2809	.567
29	55620	42820	2878	.566	52595	40445	2924	.607
30	53655	41275	2956	.605	50725	38965	3004	.648
31	51805	39805	3034	.644	48965	37575	3084	.691
32	50070	38430	3112	.685	47305	36255	3164	.734
33	48430	37130	3190	.727	45735	35015	3243	.780
34	46840	35870	3300	.771	44225	33815	3356	.826
35	45360	34700	3378	.815	42825	32705	3436	.872
36	43975	33595	3456	.861	41495	31645	3515	.923
37	42645	32545	3534	.908	40235	30645	3595	.974
38	41390	31540	3612	.957	39025	29685	3675	1.026

The above values are found on the moments of inertia of the sections with a fiber strain of 16,000 lbs. and 12,500 lbs. respectively for steel; ⅞" rivet holes deducted. Weights of girders include 12 inches of bearing at each end, stiffeners, fillers and rivet heads.

STEEL PLATE GIRDERS.

SAFE LOAD IN POUNDS, UNIFORMLY DISTRIBUTED.

Clear Span in Feet.	No. 2 G. 22 × ⅜ Web Plates. 5 ×3 ×$\frac{5}{16}$ Flange Angles. 3 ×2½×⅜ Stiffener Angles. 2½× $\frac{7}{16}$ Fillers.				No. 2 G. 22 × ⅜ Web Plates. 5 ×3 ×⅜ Flange Angles. 3 ×2½×⅜ Stiffener Angles. 2½× ⅜ Fillers.			
	Safe Load, including weight of Girder, for fiber strain of 16,000 lbs. per sq. in.	Safe Load, including weight of Girder, for fiber strain of 12,000 lbs. per sq. in.	Estimated weight of Girder.	Deflection.	Safe Load, including weight of Girder, for fiber strain of 16,000 lbs. per sq. in.	Safe Load, including weight of Girder, for fiber strain of 12,500 lbs. per sq. in.	Estimated weight of Girder.	Deflection.
14	99240	77180	1512	.....	88615	68915	1406	.....
15	92855	72185	1586	.....	82925	64445	1474	.....
16	87220	67780	1659	.....	77890	60510	1542	.....
17	82205	63845	1733	.....	73410	56990	1610	.....
18	77715	60315	1807	.....	69390	53830	1678	.....
19	73685	57105	1917	.....	65730	50960	1780	.....
20	69960	54220	1990	.297	62450	48380	1848	.297
21	66615	51595	2064	.326	59465	46035	1916	.326
22	63560	49180	2138	.357	56715	43875	1983	.357
23	60750	46970	2212	.388	54210	41900	2051	.388
24	58120	44890	2321	.421	51855	40035	2154	.421
25	55715	43005	2395	.456	49710	38350	2221	.456
26	53490	41250	2469	.492	47720	36780	2289	.491
27	51495	39605	2543	.529	45865	35315	2357	.529
28	49485	38085	2616	.567	44135	33945	2425	.567
29	47635	36615	2724	.607	42475	32635	2525	.607
30	45940	35270	2798	.648	40955	31425	2593	.648
31	44340	34010	2871	.690	39530	30300	2661	.690
32	42835	32815	2945	.734	38180	29230	2729	.734
33	41420	31690	3019	.780	36915	28225	2797	.779
34	40035	30595	3124	.826	35675	27235	2894	.825
35	38760	29580	3198	.874	34540	26340	2962	.873
36	37560	28630	3272	.923	33460	25470	3030	.923
37	36415	27715	3346	.973	32430	24650	3098	.973
38	35320	26840	3420	1.025	31455	23875	3166	1.025

The above values are found on the moments of inertia of the sections with a fiber strain of 16,000 lbs. and 12,500 lbs. respectively for steel; $\frac{1}{8}$" rivet holes deducted. Weights of girders include 12 inches of bearing at each end, stiffeners, fillers and rivet heads.

STEEL PLATE GIRDERS.

SAFE LOAD IN POUNDS, UNIFORMLY DISTRIBUTED.

Clear Span in feet.	No. 3 G. 20 × ⅝ Web Plates. 5 ×3 ×½ Flange Angles. 3 ×2½×⅝ Stiffener Angles. 2½× ½ Fillers.				No. 3 G. 20 × ⅝ Web Plates. 5 ×3 ×$\frac{7}{16}$ Flange Angles. 3 ×2½×⅝ Stiffener Angles. 2½× $\frac{7}{16}$ Fillers.			
	Safe Load, including weight of Girder, for fiber strain of 16,000 lbs. per sq. in.	Safe Load, including weight of Girder, for fiber strain of 12,500 lbs. per sq. in.	Estimated weight of Girder.	Deflection.	Safe Load, including weight of Girder, for fiber strain of 16,000 lbs. per sq. in.	Safe Load, including weight of Girder, for fiber strain of 12,500 lbs. per sq. in.	Estimated weight of Girder.	Deflection.
14	96800	75280	1548	.....	87685	68185	1443	.....
15	90575	70405	1626	.....	82045	63765	1515	.....
16	85085	66095	1703	.....	77055	59835	1586	.....
17	80180	62240	1780	.....	72625	56375	1657	.....
18	75795	58805	1857	.....	68630	53240	1728	.....
19	71795	55655	1967	.....	65020	50390	1831	.....
20	68205	52835	2044	.328	61760	47840	1902	.328
21	64940	50260	2121	.360	58795	45505	1973	.359
22	61940	47900	2199	.393	56085	43365	2044	.393
23	59195	45745	2276	.428	53585	41405	2116	.428
24	56625	43715	2386	.464	51260	39560	2218	.464
25	54275	41855	2463	.502	49130	37880	2290	.502
26	52100	40140	2540	.542	47160	36320	2361	.540
27	50065	38535	2617	.583	45320	34870	2432	.582
28	48175	37035	2694	.625	43595	33505	2503	.625
29	46365	35605	2804	.669	41955	32205	2606	.668
30	44700	34290	2881	.714	40445	31015	2677	.714
31	43140	33050	2959	.761	39030	29890	2748	.760
32	41665	31885	3036	.809	37690	28830	2820	.809
33	40275	30775	3113	.859	36430	27830	2891	.858
34	38920	29700	3220	.910	35200	26850	2990	.909
35	37675	28715	3297	.963	34070	25950	3061	.962
36	36495	27765	3374	1.017	32995	25085	3133	1.016
37	35370	26870	3451	1.073	31975	24275	3204	1.072
38	34290	26010	3528	1.130	31005	23505	3275	1.129

The above values are found on the moments of inertia of the sections with a fiber strain of 16,000 lbs. and 12,500 lbs. respectively for steel; $\frac{1}{8}$" rivet holes deducted. Weights of girders include 12 inches of bearing at each end, stiffeners, fillers and rivet heads.

STEEL PLATE GIRDERS.

SAFE LOAD IN POUNDS, UNIFORMLY DISTRIBUTED.

Clear Span in feet.	No. 3 G. 20 × ⅝ Web Plates. 5 ×3 ×⅝ Flange Angles. 3 ×2½×⅝ Stiffener Angles. 2½× ⅝ Fillers.				No. 4 G. 18 × ⅝ Web Plates. 5 ×3 ×$\frac{7}{16}$ Flange Angles. 3 ×2½×⅝ Stiffener Angles. 2½× $\frac{7}{16}$ Fillers.			
	Safe Load, including weight of Girder, for fiber strain of 16,000 lbs. per sq. in.	Safe Load, including weight of Girder, for fiber strain of 12,500 lbs. per sq. in.	Estimated weight of Girder.	Deflection.	Safe Load, including weight of Girder, for fiber strain of 16,000 lbs. per sq. in.	Safe Load, including weight of Girder, for fiber strain of 12,500 lbs. per sq. in.	Estimated weight of Girder.	Deflection.
14	78180	60800	1840	.....	76545	59505	1373	.....
15	73145	56845	1405	.....	71610	55640	1442	.....
16	68700	53360	1470	.....	67250	52210	1511	.....
17	64735	50245	1535	.....	63660	49160	1579	.....
18	61180	47460	1600	.....	59870	46410	1648	.....
19	57945	44905	1696	.....	56695	43915	1743	.....
20	55040	42620	1761	.327	53850	41670	1812	.365
21	52395	40545	1826	.359	51250	39630	1880	.400
22	49970	38630	1892	.392	48870	37750	1949	.437
23	47745	36875	1957	.427	46680	36030	2018	.476
24	45655	35225	2053	.464	44635	34415	2115	.517
25	43760	33780	2118	.502	42765	32935	2184	.559
26	41995	32385	2183	.541	41035	31565	2253	.603
27	40350	31030	2248	.582	39420	30290	2321	.648
28	38815	29825	2313	.624	37910	29100	2390	.695
29	37350	28660	2408	.668	36475	27945	2484	.744
30	36005	27585	2473	.713	35150	26900	2552	.794
31	34730	26580	2538	.760	33900	25910	2621	.846
32	33535	25635	2603	.808	32720	24980	2690	.900
33	32410	24740	2668	.857	31610	24090	2758	.955
34	31320	23870	2762	.909	30535	23235	2855	1.013
35	30300	23060	2828	.961	29535	22435	2924	1.071
36	29335	22295	2893	1.015	28585	21685	2993	1.131
37	28430	21560	2959	1.071	27690	20970	3061	1.193
38	27555	20865	3023	1.128	26830	20280	3130	1.257

The above values are found on the moments of inertia of the sections with a fiber strain of 16,000 lbs. and 12,500 lbs. respectively for steel; $\frac{1}{8}$" rivet holes deducted. Weights of girders include 12 inches of bearing at each end, stiffeners, fillers and rivet heads.

STEEL PLATE GIRDERS.

SAFE LOAD IN POUNDS, UNIFORMLY DISTRIBUTED.

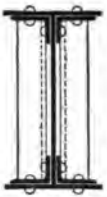
Clear Span in feet.	No. 4 G. 18 × ⅜ Web Plates. 5 ×3 ×⅜ Flange Angles. 3 ×2½×⅜ Stiffener Angles. 2½× ⅜ Fillers. Safe Load, including weight of Girder, for fiber strain of 16,000 lbs. per sq. in.	Safe Load, including weight of Girder, for fiber strain of 12,500 lbs. per sq. in.	Estimated weight of Girder.	Deflection.	No. 4 G. 18 × ⅜ Web Plates. 4 ×3 ×⅜ Flange Angles. 3 ×2½×⅜ Stiffener Angles. 2½× ⅜ Fillers. Safe Load, including weight of Girder, for fiber strain of 16,000 lbs. per sq. in.	Safe Load, including weight of Girder, for fiber strain of 12,500 lbs. per sq. in.	Estimated weight of Girder.	Deflection.
14	68170	52980	1271	.....	58900	45760	1179	.....
15	63765	49525	1333	.....	55095	42775	1237	.....
16	59875	46475	1396	.....	51725	40125	1294	.....
17	56410	43750	1459	.....	48720	37770	1352	.....
18	53300	41310	1521	.....	46020	35650	1409	.....
19	50470	39080	1610	.....	43306	33506	1494	.....
20	47925	37075	1673	.364	41360	31980	1552	.358
21	45615	35255	1735	.400	39350	30400	1609	.393
22	43490	33580	1798	.440	37515	28955	1667	.430
23	41540	32040	1861	.476	35825	27615	1724	.468
24	39710	30600	1951	.516	34240	26360	1809	.508
25	38045	29285	2014	.558	32795	25215	1866	.550
26	36505	28065	2076	.602	31455	24155	1924	.593
27	35060	26920	2139	.648	30200	23170	1981	.637
28	33710	25860	2202	.694	29080	22240	2039	.684
29	32430	24830	2289	.743	27920	21350	2121	.732
30	31250	23900	2351	.794	26890	20530	2178	.781
31	30135	23015	2414	.846	25925	19765	2236	.832
32	29085	22175	2477	.899	25015	19085	2293	.885
33	28090	21390	2539	.955	24150	18360	2351	.939
34	27120	20620	2629	1.011	23315	17685	2434	.996
35	26240	19910	2692	1.070	22540	17070	2492	1.053
36	25395	19235	2755	1.130	21800	16480	2549	1.112
37	24580	18590	2818	1.192	21105	15925	2607	1.173
38	23820	17980	2880	1.256	20435	15385	2664	1.236

The above values are found on the moments of inertia of the sections with a fiber strain of 16,000 lbs. and 12,500 lbs. respectively for steel; $\frac{11}{16}$" rivet holes deducted. Weights of girders include 12 inches of bearing at each end, stiffeners, fillers and rivet heads.

STEEL PLATE GIRDERS.

SAFE LOADS IN TONS, UNIFORMLY DISTRIBUTED.

30"×½" Web Plate. 12"×⅜" Flange Plates. 5"×3½"×½" Angles.



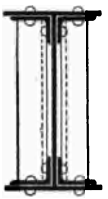
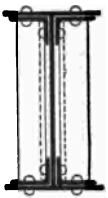
33"×½" Web Plate. 12"×⅜" Flange Plates. 5"×3½"×½" Angles.

Distance Center to Center of Bearings, in Feet.	Safe Load, including weight of girder.	Weight of girder, in tons.	Increase in safe load for ¼" increase in thickness of flange plates.	Increase in weight of girder for ¼" increase in thickness of flange plates.	Safe Load, including weight of girder.	Weight of girder, in tons.	Increase in safe load for ¼" increase in thickness of flange plates.	Increase in weight of girder for ¼" increase in thickness of flange plates.
20	81.18	1.62	4.00	.05	91.71	1.70	4.40	.05
21	77.32	1.69	3.80	.05	87.34	1.77	4.20	.05
22	73.80	1.76	3.63	.06	83.37	1.84	4.00	.06
23	70.60	1.86	3.47	.06	79.74	1.95	3.83	.06
24	67.66	1.93	3.32	.06	76.42	2.02	3.67	.06
25	64.95	2.01	3.19	.06	73.36	2.09	3.52	.06
26	62.45	2.07	3.07	.07	70.54	2.17	3.39	.07
27	60.14	2.14	2.96	.07	67.93	2.24	3.26	.07
28	57.99	2.21	2.85	.07	65.50	2.31	3.15	.07
29	55.99	2.31	2.75	.07	63.25	2.42	3.03	.07
30	54.12	2.38	2.66	.08	61.14	2.49	2.94	.08
31	52.38	2.45	2.57	.08	59.16	2.56	2.85	.08
32	50.74	2.52	2.50	.08	57.32	2.64	2.75	.08
33	49.20	2.59	2.42	.08	55.58	2.71	2.67	.08
34	47.76	2.66	2.34	.09	53.94	2.78	2.59	.09
35	46.39	2.73	2.28	.09	52.40	2.85	2.52	.09
36	45.10	2.83	2.22	.09	50.95	2.96	2.45	.09
37	43.88	2.90	2.16	.09	49.57	3.03	2.38	.09
38	42.73	2.97	2.10	.10	48.27	3.11	2.31	.10
39	41.63	3.04	2.05	.10	47.03	3.18	2.25	.10
40	40.59	3.11	2.00	.10	45.85	3.25	2.21	.10

The above values are founded on the moments of inertia of the sections using a maximum fiber strain of 18,000 lbs. per square inch for steel; ⅛" rivet holes in both flanges deducted. Weights of girders correspond to lengths center to center of bearings and include rivet heads, stiffeners and fillers.

STEEL PLATE GIRDERS.

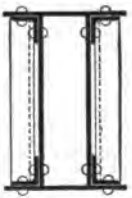
SAFE LOADS IN TONS, UNIFORMLY DISTRIBUTED.

Distance Center to Center of Bearings, in Feet.	 36"×½" Web Plate. 12"×⅞" Flange Plates. 5"×3½"×½" Angles.				 42"×⅝" Web Plate. 14"×⅞" Flange Plates. 6"×6"×⅝" Angles.			
	Safe Load, including weight of girder.	Weight of girder, in tons.	Increase in safe load for ¼" increase in thickness of flange plates.	Increase in weight of girder for ¼" increase in thickness of flange plates.	Safe Load, including weight of girder.	Weight of girder, in tons.	Increase in safe load for ¼" increase in thickness of flange plates.	Increase in weight of girder for ¼" increase in thickness of flange plates.
20	102.57	1.77	4.80	.05	152.54	2.72	6.71	.06
21	97.67	1.85	4.58	.05	145.28	2.84	6.39	.06
22	93.23	1.92	4.37	.06	138.68	2.95	6.09	.07
23	89.18	2.04	4.18	.06	132.65	3.12	5.83	.07
24	85.46	2.17	4.01	.06	127.12	3.24	5.58	.07
25	82.04	2.19	3.85	.06	122.04	3.36	5.36	.07
26	78.88	2.26	3.70	.07	117.34	3.48	5.16	.08
27	75.96	2.34	3.56	.07	113.00	3.59	4.97	.08
28	73.26	2.41	3.43	.07	108.97	3.71	4.78	.08
29	70.73	2.53	3.31	.07	105.20	3.88	4.63	.09
30	68.37	2.60	3.21	.08	101.70	4.00	4.48	.09
31	66.16	2.68	3.10	.08	98.42	4.12	4.32	.09
32	64.10	2.75	3.00	.08	95.34	4.23	4.20	.10
33	62.16	2.82	2.91	.08	92.45	4.35	4.07	.10
34	60.33	2.89	2.83	.09	89.74	4.47	3.94	.10
35	58.60	2.98	2.75	.09	87.17	4.59	3.83	.10
36	56.98	3.09	2.66	.09	84.74	4.76	3.73	.11
37	55.44	3.16	2.59	.09	82.46	4.87	3.62	.11
38	53.98	3.24	2.52	.10	80.29	4.99	3.53	.11
39	52.59	3.31	2.47	.10	78.23	5.11	3.43	.12
40	51.26	3.39	2.40	.10	76.27	5.23	3.35	.12

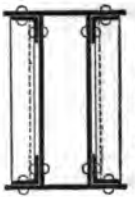
The above values are founded on the moments of inertia of the sections using a maximum fiber strain of 13,000 lbs. per square inch for steel; $\frac{13}{16}$" rivet holes in both flanges deducted. Weights of girders correspond to lengths center to center of bearings and include rivet heads, stiffeners and fillers.

STEEL BOX GIRDERS.

SAFE LOADS IN TONS, UNIFORMLY DISTRIBUTED.



30"×½" Web Plates. 16"×⅜" Flange Plates. 3½"×3½"×½" Angles.



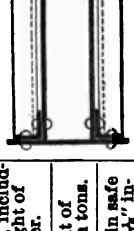
33"×½" Web Plates. 20"×⅜" Flange Plates. 3½"×3½"×½" Angles.

Distance Center to Center of Bearings, in Feet.	Safe Load, including weight of girder.	Weight of girder, in tons.	Increase in safe load for ¼" increase in thickness of flange plates.	Increase in weight of girder for ¼" increase in thickness of flange plates.	Safe Load, including weight of girder.	Weight of girder, in tons.	Increase in safe load for ¼" increase in thickness of flange plates.	Increase in weight of girder for ¼" increase in thickness of flange plates.
20	97.59	2.13	5.73	.07	130.2	2.44	7.95	.09
21	92.94	2.23	5.46	.07	124.0	2.55	7.58	.09
22	88.72	2.32	5.20	.08	118.3	2.66	7.22	.09
23	84.86	2.45	4.98	.08	113.2	2.80	6.90	.10
24	81.32	2.54	4.78	.08	108.5	2.91	6.62	.10
25	78.07	2.64	4.59	.09	104.1	3.03	6.35	.11
26	75.07	2.74	4.41	.09	100.1	3.14	6.12	.11
27	72.29	2.83	4.25	.09	96.4	3.25	5.89	.12
28	69.70	2.93	4.10	.10	93.0	3.36	5.67	.12
29	67.30	3.06	3.96	.10	89.8	3.50	5.48	.12
30	65.06	3.16	3.82	.10	86.8	3.61	5.29	.13
31	62.96	3.25	3.70	.11	84.0	3.72	5.13	.13
32	61.00	3.35	3.58	.11	81.4	3.83	4.97	.14
33	59.14	3.50	3.48	.11	78.9	3.95	4.82	.14
34	57.40	3.54	3.38	.12	76.6	4.06	4.67	.14
35	55.76	3.64	3.28	.12	74.4	4.17	4.53	.15
36	54.22	3.76	3.18	.12	72.3	4.31	4.41	.15
37	52.75	3.86	3.09	.13	70.4	4.41	4.30	.16
38	51.36	3.95	3.02	.13	68.5	4.53	4.18	.16
39	50.04	4.05	2.94	.13	66.7	4.65	4.07	.17
40	48.80	4.15	2.86	.14	65.1	4.76	3.97	.17

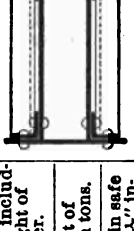
The above values are founded on the moments of inertia of the sections using a maximum fiber strain of 13,000 lbs. per square inch for steel; ⅞" rivet holes in both flanges deducted. Weights of girders correspond to lengths center to center of bearings and include rivet heads, stiffeners and fillers.

STEEL BOX GIRDERS.

SAFE LOADS IN TONS, UNIFORMLY DISTRIBUTED.



36"×⅜" Web Plates.
24"×⅞" Flange Plates.
4"×3½"×½" Angles.



42"×½" Web Plates.
30"×1⅛" Flange Plates.
5"×4"×½" Angles.

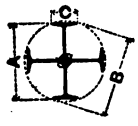
Distance Center to Center of Bearings, in Feet.	Safe Load, including weight of girder.	Weight of girder, in tons.	Increase in safe load for ¼" increase in thickness of flange plates.	Increase in weight of girder for ¼" increase in thickness of flange plates.	Safe Load, including weight of girder.	Weight of girder, in tons.	Increase in safe load for ¼" increase in thickness of flange plates.	Increase in weight of girder for ¼" increase in thickness of flange plates.
20	184.9	2.92	10.59	.10	278.5	3.78	15.80	.13
21	176.2	3.06	10.10	.11	274.8	3.95	15.05	.13
22	168.2	3.19	9.64	.11	262.3	4.13	14.37	.14
23	160.8	3.36	9.22	.12	251.0	4.34	13.74	.15
24	154.2	3.49	8.84	.12	240.5	4.52	13.17	.15
25	148.0	3.63	8.48	.13	230.9	4.69	12.64	.16
26	142.4	3.76	8.18	.13	222.0	4.87	12.16	.17
27	137.0	3.89	7.85	.14	213.8	5.04	11.70	.17
28	132.1	4.03	7.57	.14	206.2	5.21	11.29	.18
29	127.6	4.15	7.31	.15	199.0	5.43	10.91	.19
30	123.3	4.33	7.06	.15	192.4	5.61	10.54	.19
31	119.3	4.45	6.83	.16	186.2	5.78	10.21	.20
32	115.6	4.60	6.63	.16	180.3	5.95	9.88	.20
33	112.1	4.74	6.43	.17	174.9	6.12	9.58	.21
34	108.8	4.87	6.24	.17	169.8	6.29	9.30	.22
35	105.7	5.00	6.06	.18	164.9	6.47	9.03	.22
36	102.8	5.17	5.90	.18	160.3	6.69	8.78	.23
37	100.0	5.31	5.74	.19	156.0	6.86	8.54	.24
38	97.4	5.44	5.58	.19	151.9	6.94	8.32	.24
39	94.9	5.58	5.44	.20	148.0	7.20	8.11	.25
40	92.5	5.71	5.30	.20	144.3	7.38	7.91	.26

The above values are founded on the moments of inertia of the sections using a maximum fiber strain of 13,000 lbs. per square inch for steel; $\frac{1}{16}$" rivet holes in both flanges deducted. Weights of girders correspond to lengths center to center of bearings and include rivet heads, stiffeners and fillers.

SAFE LOAD IN TONS OF 2,000 LBS. FOR 16" LARIMER ALL STEEL COLUMNS.

Allowed strain per square inch $= \begin{cases} 12{,}000 \text{ lbs. for lengths of 90 radii or under.} \\ 17{,}100 - 57\,\frac{l}{r} \text{ for lengths over 90 radii.} \end{cases}$

⅞" Rivets in Web and Flange.

Section No. of Beam.	Weight per foot of Single Beam.	Weight per foot of Filler.	Weight per foot of Column without fittings.	Sectional Area of Column.	Minimum Radius of Gyration.	Length of Column in Feet.							
No.	Lbs.	Lbs.	Lbs.	Sq. in.	Inches.	40	38	36	34	32 and under.	A	B	C
B-3	60	10.5	131.25	38.4	4.36	208	214	220	226	232	16"	17 1/16"	6"
B-4	55	10.5	121.25	35.7	4.10	186	192	198	204	210	16 1/16"	17 1/16"	5 3/4"
B-4	50	10.5	111.25	32.8	4.18	173	178	184	189	195	16"	17"	5 1/4"
B-4	45	10.5	101.25	29.8	4.28	160	164	169	174	179	15 13/16"	16 1/16"	5 5/16"
B-4	42	10.5	95.25	28.1	4.32	151	155	160	165	169	15 7/8"	16 1/8"	5 1/4"

SAFE LOAD IN TONS OF 2,000 LBS. FOR 13" LARIMER ALL STEEL COLUMNS.

Allowed strain per square inch $= \begin{cases} 12{,}000 \text{ lbs. for lengths of 90 radii or under.} \\ 17{,}100 - 57\frac{l}{r} \text{ for lengths over 90 radii.} \end{cases}$

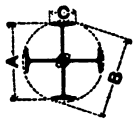
¾" Rivets in Web and Flange.

Section No. of Beam.	Weight per foot of Single Beam.	Weight per foot of Filler.	Weight per foot of Column without fittings.	Sectional Area of Column.	Minimum Radius of Gyration.	Length of Column in Feet.											
No.	Lbs.	Lbs.	Lbs.	Sq. in.	Inches.	40	38	36	34	32	30	28	26	24 and under	A	B	C
B-5	45	10.5	101.25	29.7	3.40	134	140	146	152	158	164	170	176	178	13"	14 1/16"	5 1/8"
B-5	40	10.5	91.25	26.8	3.50	124	129	135	140	145	151	156	161	161	12 1/2"	13 1/16"	5 1/2"
B-6	40	10.5	91.25	26.6	3.36	119	124	129	135	140	146	151	157	160	12 3/16"	13 1/16"	5 3/16"
B-6	35	10.5	81.25	23.7	3.42	108	113	117	122	127	132	136	141	142	12 1/4"	13 1/16"	5 3/32"
B-6	31.5	10.5	74.25	21.6	3.51	101	105	109	113	118	122	126	130	130	12 1/16"	13 3/16"	5"

SAFE LOAD IN TONS OF 2,000 LBS. FOR 11" LARIMER ALL STEEL COLUMNS.

Allowed strain per square inch — { 12,000 lbs. for lengths of 90 radii or under. / 17,100 − 57 $\frac{l}{r}$ for lengths over 90 radii.

¾" Rivets in Web and Flange.

Section No. of Beam.	Weight per foot of Single Beam.	Weight per foot of Filler.	Weight per foot of Column without fittings.	Sectional Area of Column.	Minimum Radius of Gyration.	Length of Column in Feet.												
No.	Lbs.	Lbs.	Lbs.	Sq. in.	Inches.	40	38	36	34	32	30	28	26	24	22 and under	A	B	C
B-7	30	10.5	71.25	20.8	2.84	78	83	88	93	98	103	108	113	118	123	10⅞"	11⅛"	4⅛"
B-7	25	10.5	61.25	17.8	2.94	69	73	77	82	86	90	94	98	103	107	10⅜"	11⅛"	4¼"

SAFE LOAD IN TONS OF 2,000 LBS. FOR 10" LARIMER ALL STEEL COLUMNS.

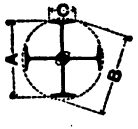
¾" Rivets in Web and Flange.

No.	Lbs.	Lbs.	Lbs.	Sq. in.	Inches.	36	34	32	30	28	26	24	22	20 and under	A	B	C
B-8	25.0	10.5	61.25	18.1	2.57	68	73	77	82	87	92	97	101	106	9⅞"	10⅛"	4⅛"
B-8	21.0	10.5	53.25	15.7	2.66	62	66	70	74	78	82	86	89	94	9½"	10⅛"	4¼"

SAFE LOAD IN TONS OF 2,000 LBS. FOR 9" LARIMER ALL STEEEL COLUMNS.

Allowed strain per square inch — { 12,000 lbs. for lengths of 90 radii or under. / 17,100 − 57 $\frac{l}{r}$ for lengths over 90 radii.

⅞" Rivets in Web.
¾" Rivets in Flange.

Section No. of Beam.	Weight per foot of Single Beam.	Weight per foot of Filler.	Weight per foot of Column without fittings.	Sectional Area of Column.	Minimum Radius of Gyration.	Length of Column in Feet.												
No.	Lbs.	Lbs.	Lbs.	Sq. in.	Inches.	36	34	32	30	28	26	24	22	20	18 and under	A	B	C
B-9	22.75	6.0	52.0	15.4	2.37	52	56	60	64	69	74	77	82	86	91	9"	9⅛"	4⅝"
B-9	20.25	6.0	47.0	13.9	2.41	48	52	56	60	63	67	71	75	79	83	8⅛"	9⅛"	4⅜"
B-9	17.75	6.0	42.0	12.4	2.47	44	47	51	54	58	61	65	68	72	75	8⅛"	9"	4"

SAFE LOAD IN TONS OF 2,000 LBS. FOR 8" LARIMER ALL STEEL COLUMNS.

¾" Rivets in Web and Flange.

No.	Lbs.	Lbs.	Lbs.	Sq. in.	Inches.	36	34	32	30	28	26	24	22	20	18	16 and under	A	B	C
B-10	20.0	6.0	46.5	13.6	2.10	36	40	45	49	54	58	63	67	72	76	81	8"	8¼"	3⅞"
B-10	17.5	6.0	41.5	12.1	2.12	33	37	41	45	49	52	56	60	64	68	72	7⅛"	8¼"	3¾"
B-10	15.0	6.0	36.5	10.6	2.16	30	34	37	40	44	47	50	54	57	60	64	7⅛"	8⅛"	3⅝"

SAFE LOAD IN TONS OF 2,000 LBS. FOR 7" LARIMER ALL STEEL COLUMNS.

Allowed strain per square inch $= \begin{cases} 12{,}000 \text{ lbs. for lengths of 90 radii or under.} \\ 17{,}100 - 57\,\frac{l}{r} \text{ for lengths over 90 radii.} \end{cases}$

⅞" Rivets in Web and Flange.

Section No. of Beam.	Weight per foot of Single Beam.	Weight per foot of Filler.	Weight per foot of Column without fittings.	Sectional Area of Column.	Minimum Radius of Gyration.	Length of Column in Feet.										A	B	C
No.	Lbs.	Lbs.	Lbs.	Sq. in.	Inches.	32	30	28	26	24	22	20	18	16	14 and under.			
B-11	14.75	6	36	10.5	1.85	27	31	35	39	43	47	50	54	58	62	6⅛"	7½"	3 1/16"
B-11	12.25	6	31	9.0	1.88	25	28	31	34	38	41	44	47	51	54	6⅛"	7 5/16"	3⅛"

SAFE LOAD IN TONS OF 2,000 LBS. FOR 8" LARIMER ALL STEEL COLUMNS.

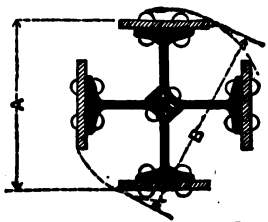
⅞" Rivets in Web.
1" Rivets in Flange.

No.	Lbs.	Lbs.	Lbs.	Sq. in.	Inches.	30	28	26	24	22	20	18	16	14	12 and under.	A	B	C
B-12	12.25	6	31	9.0	1.56	18	22	26	30	34	37	41	45	49	53	5⅛"	6½"	3⅛"
B-12	9.75	6	26	7.5	1.62	17	20	23	26	29	32	36	39	42	45	5⅛"	6 5/16"	3"

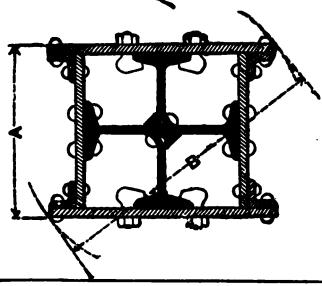
SAFE LOAD IN TONS OF 2,000 LBS. FOR REINFORCED LARIMER ALL STEEL COLUMNS.

Allowed Strain per Square Inch=12,000 Lbs.

Size of I Beam.	Weight per foot of Single Beam.	Weight per foot of Filler.	REINFORCED WITH	Weight per foot of Column, without fittings.	Sectional Area of Column.	Safe Load of Column 26 foot and under.	Size of Column.	
In.	Lbs	Lbs		Lbs.	Sq.In.	Tons.	A	B
15	60	10½	4 Pl. 7½″×⅝″	198.17	57.13	344.2	17⅛″	18¾″
15	60	10½	4 Pl. 7½″×¾″	211.90	60.88	365.7	17⅜″	19″
15	60	10½	4 Pl. 9″×¾″	226.24	65.38	393.7	17⅝″	19⅝″
15	60	10½	4 Pl. 9″×⅞″	245.70	69.88	420.7	17⅝″	19⅞″
15	60	10½	2 Pl. 15⅞″×$\frac{7}{16}$ 2 Pl. 22⅜″×$\frac{7}{16}$ 4 L 2½″×2½″×$\frac{7}{8}$″	279.85	80.35	482.5	16¾″	20⅞″
15	60	10½	2 Pl. 15⅞″×½″ 2 Pl. 22⅜″×½″ 4 L 2½″×2½″×$\frac{7}{16}$″	296.18	86.36	518.5	16⅞″	26$\frac{1}{16}$″
15	60	10½	2 Pl. 15⅞″×⅝″ 2 Pl. 22⅜″×⅝″ 4 L 2½″×2½″×½″	332.99	95.90	575.8	17⅛″	27⅛″
15	60	10½	2 Pl. 15⅞″×¾″ 2 Pl. 22⅜″×¾″ 4 L 2½″×2½″×½″	366.95	105.55	633.7	17⅜″	27¼″



REINFORCED PLAIN COLUMN.

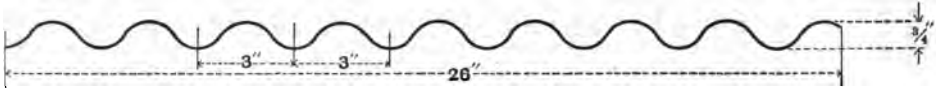


REINFORCED BOX COLUMN.

SAFE LOADS, IN TONS OF 2,000 LBS., FOR HOLLOW CYLINDRICAL CAST IRON COLUMNS.

Outside diam., inches.	Thickness of Metal.	LENGTH OF COLUMNS, IN FEET.									Sectional Area, inches.	Weight, lbs. of columns per foot of length.
		8	10	12	14	16	18	20	22	24		
6	1/2	26.2	23.0	20.1	17.5	15.2	13.2	11.5	.....	.....	8.6	26.95
6	3/4	37.5	33.0	28.8	25.0	21.7	18.9	16.5	.....	.....	12.4	38.59
6	7/8	42.7	37.6	32.8	28.5	24.7	21.5	18.8	.....	.....	14.1	43.96
6	1	47.6	41.9	36.5	31.8	27.6	24.0	21.0	.....	.....	15.7	49.01
6	1 1/8	52.2	46.0	40.1	34.8	30.2	26.3	23.0	.....	.....	17.2	53.76
7	3/4	47.7	43.1	38.5	34.3	30.4	26.9	23.9	21.2	18.9	14.7	45.96
7	1	61.1	55.2	49.3	43.8	38.9	34.4	30.6	27.1	24.2	18.9	58.90
7	1 1/8	67.2	60.8	54.3	48.3	42.8	37.9	33.7	29.9	26.7	20.8	64.77
8	3/4	57.9	53.3	48.6	44.1	39.7	35.8	32.2	28.9	26.1	17.1	53.29
8	1	74.6	68.7	62.5	56.7	51.1	46.0	41.4	37.3	33.6	22.0	68.64
8	1 1/8	89.9	82.8	75.5	68.4	61.7	55.5	49.9	44.9	40.5	26.5	82.71
9	3/4	68.1	63.6	58.9	54.2	49.6	45.2	41.2	37.5	34.1	19.4	60.65
9	1	88.0	82.3	76.2	70.0	64.1	58.4	53.2	48.4	44.1	25.1	78.40
9	1 1/8	106.6	99.6	92.2	84.8	77.6	70.8	64.4	58.7	53.4	30.4	94.94
9	1 1/4	123.8	115.7	107.1	98.5	90.1	82.2	74.8	68.1	62.0	35.3	110.26
9	1 3/8	139.6	130.5	120.8	111.1	101.6	92.7	84.4	76.8	69.9	39.9	124.36
10	1	101.4	95.9	89.8	83.6	77.4	71.5	65.8	60.5	55.5	28.3	88.23
10	1 1/8	123.3	116.5	109.1	101.6	94.1	86.8	79.9	73.4	67.5	34.4	107.23
10	1 1/4	143.7	135.8	127.3	118.5	109.7	101.2	93.2	85.6	78.7	40.1	124.99
10	1 3/8	162.7	153.8	144.1	134.1	124.2	114.6	105.5	97.0	89.1	45.4	141.65
11	1	114.8	109.4	103.5	97.3	91.0	84.8	80.2	73.1	67.7	31.4	98.03
11	1 1/4	139.9	133.3	126.1	118.6	110.9	103.3	97.8	89.4	82.5	38.3	119.46
11	1 1/2	163.5	155.9	147.5	138.6	128.7	120.8	114.3	104.1	96.4	44.8	139.68
11	1 3/4	185.7	177.1	167.5	157.5	147.3	137.2	129.8	118.3	109.5	50.9	158.68
12	2	206.6	196.9	186.3	175.1	163.8	152.6	144.4	131.5	121.8	56.6	176.44
12	1	128.0	122.9	117.2	111.0	104.7	98.4	92.2	86.1	80.4	34.6	107.51
12	1 1/4	156.4	150.1	143.1	135.7	127.9	120.2	112.6	105.2	98.2	42.2	131.41
12	1 1/2	183.3	175.9	167.7	159.0	149.9	140.9	132.0	123.3	115.1	49.5	154.10
12	1 3/4	208.7	200.4	191.0	181.1	170.7	160.4	150.3	140.5	131.1	56.4	175.53
12	2	232.7	223.4	213.0	201.9	190.4	178.9	167.6	156.6	146.1	62.8	195.75
13	1	141.2	136.3	130.7	124.7	118.5	112.1	105.8	99.5	93.5	37.7	117.53
13	1 1/4	172.8	166.8	160.0	152.7	145.0	137.2	129.4	121.8	114.4	46.1	143.86
13	1 1/2	203.0	195.9	187.9	179.3	170.3	161.1	152.0	143.1	134.3	54.2	168.98
13	1 3/4	231.6	223.6	214.5	204.7	194.4	183.9	173.5	163.3	153.3	61.9	192.88
13	2	258.9	249.9	239.7	228.7	217.3	205.5	193.9	182.5	171.3	69.1	215.56
14	1	154.3	149.6	144.3	138.5	132.3	125.9	119.5	113.1	106.8	40.8	127.60
14	1 1/4	189.2	183.4	176.9	169.7	162.2	154.4	146.5	138.6	131.0	50.1	156.31
14	1 1/2	222.6	215.8	208.1	199.7	190.8	181.7	172.8	163.1	154.1	58.9	183.67
14	1 3/4	254.4	246.7	237.9	228.3	218.1	207.6	197.0	186.5	176.2	67.4	210.00
14	2	284.8	276.2	266.4	255.6	244.2	232.4	220.6	208.8	197.2	75.4	235.12
15	1	167.4	162.9	157.8	152.1	146.0	139.7	133.3	126.8	120.4	44.0	137.28
15	1 1/4	205.5	200.0	193.7	186.7	179.3	171.5	163.6	155.7	147.9	54.0	168.48
15	1 1/2	242.1	235.7	228.2	220.0	211.2	202.1	192.8	183.5	174.2	63.6	198.74
15	1 3/4	277.2	269.8	261.3	251.9	241.9	231.4	220.7	210.1	199.5	72.9	227.45
15	2	310.8	302.5	293.0	282.5	271.2	259.5	247.5	235.5	223.6	81.7	254.90

SAFE LOAD IN LBS. EQUALLY DISTRIBUTED FOR CORRUGATED SHEETS OF DIFFERENT SPANS AND THICKNESS.



No. by Birmingham gauge.	Thickness in inches.	Weight per square foot flat.	Weight per square foot corrugated.	3′ 0″ Span.		4′ 0″ Span.		5′ 0″ Span.		6′ 0″ Span.		7′ 0″ Span.	
				Safe load per sheet between supports.	Safe load per square ft.	Safe load per sheet between supports.	Safe load per square ft.	Safe load per sheet between supports.	Safe load per square ft.	Safe load per sheet between supports.	Safe load per square ft.	Safe load per sheet between supports.	Safe load per square ft.
18	.049	1.97	2.16	663	102	497	57	398	37	331	25	284	18
20	.035	1.40	1.54	473	73	355	41	284	26	236	18	203	14
22	.028	1.12	1.23	379	58	284	33	227	21	189	14	162	10
24	.022	.88	.97	297	46	223	26	178	16	149	11	128	8

Sheets are 28¼" inches wide before, and 26" wide after corrugating.
There are 8⅔ corrugations in a sheet.
Sheets can be rolled any length to 10′ 0″.
It is not advisable to use over 6′ 0″ clear spans on roofs.

WOODEN BEAMS.

Table of safe quiescent loads for horizontal rectangular beams of white pine or spruce one inch broad, supported at both ends, the load being equally distributed over the span.

SPAN IN FEET	DEPTH OF BEAM IN INCHES.										
	6	7	8	9	10	11	12	13	14	15	16
5	800	1090	1420	1800	2220	2690	3200	3750	4350	5000	5690
6	670	910	1180	1500	1850	2240	2670	3130	3630	4170	4740
7	570	780	1010	1290	1590	1920	2280	2680	3110	3570	4060
8	500	680	890	1120	1390	1680	2000	2350	2720	3130	3560
9	440	600	790	1000	1210	1490	1780	2090	2420	2780	3160
10	400	540	710	900	1110	1340	1600	1880	2180	2500	2840
11	360	490	650	820	1010	1220	1450	1710	1980	2270	2590
12	330	450	590	750	930	1120	1330	1560	1810	2080	2370
13	310	420	550	690	850	1030	1230	1440	1680	1920	2190
14	290	390	510	640	790	960	1140	1340	1560	1790	2030
15	270	360	470	600	740	900	1070	1250	1450	1670	1900
16	250	340	440	560	690	840	1000	1170	1360	1560	1780
17	230	320	420	530	650	790	940	1100	1280	1470	1670
18	220	300	400	500	620	750	890	1040	1210	1390	1580
19	210	290	380	470	590	710	840	990	1150	1320	1500
20	200	270	360	450	560	670	800	940	1090	1250	1420
21	190	260	340	430	530	640	760	890	1040	1190	1350
22	180	250	320	410	500	610	730	850	990	1140	1290
23	170	240	300	390	480	580	700	810	950	1090	1230
24	160	230	290	370	460	560	670	780	910	1040	1180
25	160	220	280	350	440	540	640	750	870	1000	1130
26	150	210	270	340	420	520	610	720	840	960	1090
27	150	200	260	330	400	500	590	690	810	920	1050
28	140	190	250	320	490	480	570	670	780	890	1010
29	140	190	250	310	380	460	550	650	750	860	980
30	130	180	240	300	370	450	530	630	730	830	950

This table has been calculated for extreme fiber strain of 1000 lbs. per square inch, giving a safety of 6 in ordinary building timber of fair quality.

Oak and yellow pine will carry a load one-fourth greater.

When more accuracy is required the weight of the beam itself must be deducted.

Care must be taken to let the beams rest for a sufficient distance on their supports to guard against crushing at the ends, especially in placing very heavy loads upon short, but deep and strong beams.

SAFE LOADS IN TONS OF 2,000 LBS. FOR SINGLE BEAM COLUMNS.

Assumed strain per square inch—12,500 lbs. Reduced by Gordon's formula.

Depth of Beam.	Weight per foot.	Length in Feet.										
		10	12	14	16	18	20	22	24	26	28	30
24	100	148	135	124	113	102	93	84	76	70	...	...
24	80	117	110	102	94	86	78	71	65	59	54	49
20	100	151	140	129	117	108	98	89	82	74	67	62
20	80	123	114	105	97	89	81	74	67	62	57	52
20	64	94	86	78	70	63	57	51	46	42	...	...
15	100	149	138	126	115	105	95	86	79	71	62	...
15	80	120	111	102	93	85	77	70	63	58	53	...
15	60	87	80	72	66	59	53	48	43	39	...	...
15	42	58	52	46	41	36	32	28	...	...	...	...
12	55	74	66	59	52	46	41	36	...	...	...	...
12	40	54	50	44	39	35	31	28	...	...	...	...
12	31½	42	37	33	29	26	23	20	...	...	...	...
10	40	49	43	37	32	28	25	...	...	...	...	...
10	25	32	28	25	22	19	17	...	...	...	...	...
9	35	41	35	30	26	23	...	...	...	...	...	...
9	21	26	23	20	17	15	13	...	...	...	...	...
8	25½	28.2	24.5	20.8	17.8	15.6	...	...	...	...	...	...
8	17½	20.9	18	15.5	13.3	11.5	...	...	...	...	...	...
7	20	21.2	17.9	15	12.8	...	...	...	...	...	...	...
7	15	16.6	14.1	12	10.3	...	...	...	...	...	...	...
6	17½	17	15.1	11.8	10	...	...	...	...	...	...	...
6	12½	12.7	10.7	9	7.6	...	...	...	...	...	...	...
5	14¾	13.5	11	9.1	...	...	...	...	...	...	...	...
5	9¾	9.2	7.5	6.3	...	...	...	...	...	...	...	...
4	10½	8.7	7	...	...	...	...	...	...	...	...	...
4	7½	6.4	5.1	...	...	...	...	...	...	...	...	...
3	7½	5.6	4.4	...	...	...	...	...	...	...	...	...
3	5½	4.2	3.3	...	...	...	...	...	...	...	...	...

ULTIMATE STRENGTH OF STEEL STRUTS.

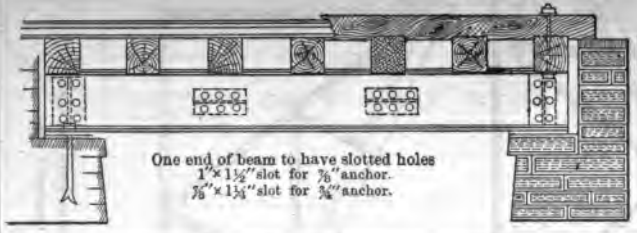
For different proportions of length in feet — l,
To least radius of gyration in inches — r.
Ultimate strength in lbs. per square inch —

Column — 50000 / Sq. Bearing $1+\frac{(12\,l)^2}{36000r^2}$ Column — 50000 / Pin & S. Bear. $1+\frac{(12\,l)^2}{24000r^2}$ Column — 50000 / Pin Bear. $1+\frac{(12\,l)^2}{18000r^2}$

To obtain safe resistance. { For quiescent loads, as in buildings, divide by 4. / For moving loads, as in bridges, divide by 5.

$\frac{l}{r}$	Ultimate Strength in lbs. per square inch. Square.	Pin and Square.	Pin.	$\frac{l}{r}$	Ultimate Strength in lbs. per square inch. Square.	Pin and Square.	Pin.
3.0	48262	47437	46637	12.0	31735	26695	23237
3.2	48087	47100	46212	12.2	31337	26412	23035
3.4	47787	46750	45762	12.4	30962	26012	22425
3.6	47537	46387	45300	12.6	30587	25612	22025
3.8	47275	46012	44825	12.8	30212	25225	21637
4.0	46987	45625	44325	13.0	29837	24825	21250
4.2	46700	45212	43812	13.2	29462	24450	20887
4.4	46400	44800	43300	13.5	28925	23887	20350
4.6	46087	44375	42762	13.8	28375	23337	19812
4.8	45775	43925	42212				
5.0	45450	43475	41662	14.0	28025	22975	19475
5.2	45112	43025	41112	14.2	27687	22625	19137
5.4	44775	42562	40550	14.5	27175	22112	18650
5.6	44425	42087	39975	14.8	26650	21612	18162
5.8	44075	41600	39400				
6.0	43712	41112	38825	15.0	26312	21275	17862
6.2	43337	40625	38237	15.2	25987	20950	17550
6.4	42962	40137	37662	15.5	25362	20487	17112
6.6	42575	39637	37087	15.8	25025	20012	16687
6.8	42187	39137	36500				
				16.0	24700	19712	16400
7.0	41800	38637	35925	16.2	24387	19425	16137
7.2	41412	38137	35337	16.5	23937	18987	15737
7.4	41012	37637	34775	16.8	23487	18562	15350
7.6	40612	37137	34200				
7.8	40212	36637	33637	17.0	23187	18287	15100
				17.2	22900	18012	14850
8.0	39812	36125	33075	17.5	22475	17625	14487
8.2	39400	35625	32512	17.8	22050	17237	14150
8.4	38987	35125	31962				
8.6	38587	34625	31412	18.0	21775	16987	13925
8.8	38175	34137	30875	18.2	21500	16737	13700
				18.5	21100	16375	13375
9.0	37762	33650	30337	18.8	20712	16025	13062
9.2	37350	33162	29812				
9.4	36937	32675	29287	19.0	20462	15787	12862
9.6	36537	32200	28785	19.2	20212	15562	12662
9.8	36125	31712	28275	19.5	19837	15237	12362
				19 8	19462	14912	12087
10.0	35712	31250	27775				
10.2	35312	30787	27287	20.0	19225	14700	11900
10.4	34900	30325	26800	20.2	19000	14500	11725
10.6	34500	29862	26325	20.5	18650	14200	11462
10.8	34087	29412	25862	20.8	18312	13900	11212
11.0	33687	28962	25412	21.0	18140	13710	11040
11.2	33300	28525	24950	21.2	17870	13520	10880
11.4	32900	28087	24512	21.5	17550	13250	10640
11.6	32500	27662	24087	21.8	17240	12980	10410
11.8	32112	27250	23662				

I BEAM BRIDGES



One end of beam to have slotted holes
1" × 1½" slot for ⅞" anchor.
⅞" × 1¾" slot for ¾" anchor.

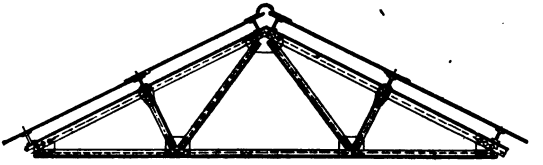
DOUBLE

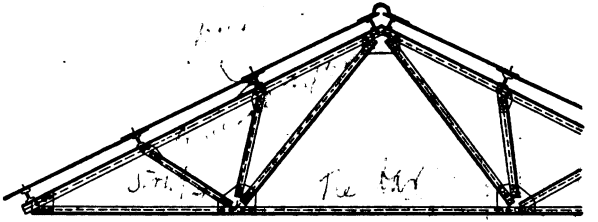
SIZE	SEPARATORS	BEARING PLATES	WEDGE & ANCHORS.	WASHERS
24"	20"-I-64#1'-6"	18" × ¾" × 2'-8"	⅞" × 12"	2½" × 2¼" × ½" × ¼"
20"	20"-I-64#1'-3"	12" × ¾" × 2'-6"	⅞" × 12"	2½" × 2½" × ½" × ¼"
15"	15"-I-42#0'-11"	12" × ¾" × 2'-0"	⅞" × 12"	2½" × 2½" × ½" × ¼"
12"	12"-I-31½#0'-9"	12" × ¾" × 1'-9"	¾" × 10"	2" × ½" × ¼" × 2½"
10"	10"-I-25#0'-7"	12" × ¾" × 1'-6"	¾" × 10"	2" × ½" × ¼" × 2½"

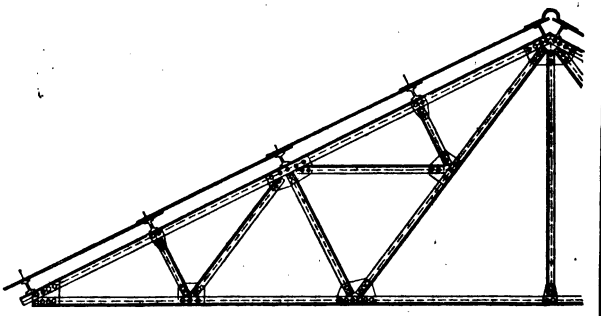
TRIPLE

SIZE	SEPARATORS	BEARING PLATES	WEDGE & ANCHORS.	WASHERS
24"	10"-I-25#1'-6"	18" × ¾" × 2'-8"	⅞" × 12"	2½" × 2½" × ½" × ¼"
20"	10"-I-25#1'-3"	12" × ¾" × 2'-8"	⅞" × 12"	2½" × 2½" × ½" × ¼"
15"	10"-I-25#0'-11"	12" × ¾" × 2'-6"	⅞" × 12"	2½" × 2½" × ½" × ¼"

STANDARD DETAILS FOR ROOF TRUSSES.







Notes; Distance from center to center of purlins should not exceed 6'0"
Roof covering generally used #20 Corrugated Steel.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 175 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	24 Inch Beam, Standard				
	100 lbs.	95 lbs.	90 lbs.	85 lbs.	80 lbs.
10	120.3	116.8	113.2	109.6	106.0
11	99.5	96.5	93.5	90.6	87.6
12	83.6	81.1	78.6	76.1	73.6
13	71.2	69.1	67.0	64.9	62.7
14	61.4	59.6	57.8	55.9	54.2
15	53.5	51.9	50.3	48.7	47.1
16	46.9	45.6	44.2	42.8	41.4
17	41.7	40.4	39.1	37.9	36.7
18	37.1	36.0	34.9	33.8	32.8
19	33.3	32.3	31.3	30.3	29.4
20	30.1	29.2	28.3	27.4	26.5
21	27.3	26.5	25.7	24.9	24.1
22	24.8	24.1	23.4	22.6	21.9
23	22.7	22.1	21.4	20.7	20.0
24	20.9	20.3	19.7	19.0	18.4
25	19.3	18.7	18.1	17.5	17.0
26	17.8	17.2	16.7	16.2	15.7
27	16.5	16.0	15.5	15.0	14.6
28	15.4	14.9	14.5	14.0	13.5
29	14.3	13.9	13.4	13.0	12.6
30	13.4	13.0	12.6	12.2	11.8

For load of 350 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 175 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	20 Inch Beam, Heavy Section.				
	100 lbs.	95 lbs.	90 lbs.	85 lbs.	80 lbs.
10	101.3	98.3	95.4	92.3	89.4
11	83.4	81.0	78.6	76.3	73.9
12	70 3	68.3	66.2	64.1	62.1
13	59.9	58.2	56.4	54.6	52.9
14	51.7	50.2	48.6	47.1	45.6
15	45.0	43.7	42.4	41.0	39.7
16	39.6	38.4	37.3	36.1	34.9
17	35.1	34.0	32.9	31.9	30.9
18	31.2	30.3	29.4	28.5	27.6
19	28.1	27.3	26.4	25.6	24.7
20	25.3	24.6	23.8	23.1	22.3
21	23.0	22.3	21.7	21.0	20.2
22	20.9	20.3	19.7	19.1	18.5
23	19.1	18.6	18.0	17.5	16.9
24	17.6	17.1	16.6	16.0	15.5
25	16.2	15.7	15.3	14.8	14.3
26	15.0	14.5	14.1	13.7	13.2
27	13.9	13.5	13.1	12.7	12.3
28	12.9	12.5	12.2	11.8	11.4
29	12.1	11.7	11.3	11.0	10.6
30	11.3	10.9	10.6	10.2	9.9

For load of 350 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 175 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	20 Inch Beam, Standard.				
	80 lbs.	75 lbs.	70 lbs.	65 lbs.	64 lbs.
10	80.9	77.9	74.9	71.9	71.2
11	66.8	64.4	61.9	59.4	58.9
12	56.2	54.1	52.1	49.9	49.5
13	47.8	46.1	44.3	42.5	42.2
14	41.3	39.7	38.2	36.7	36.3
15	35.9	34.6	33.3	31.9	31.7
16	31.6	30.4	29.3	28.1	27.8
17	27.9	26.9	25.9	24.9	24.7
18	25.0	24.1	23.1	22.2	22.0
19	22.4	21.5	20.7	19.9	19.8
20	20.2	19.5	18.7	17.9	17.8
21	18.3	17.7	17.0	16.3	16.2
22	16.7	16.1	15.5	14.9	14.7
23	15.3	14.7	14.2	13.6	13.5
24	14.1	13.5	13.0	12.5	12.3
25	12.9	12.5	12.0	11.5	11.4
26	11.9	11.5	11.1	10.6	10.5
27	11.1	10.7	10.3	9.9	9.8
28	10.3	9.9	9.6	9.2	9.1
29	9.6	9.3	8.9	8.6	8.5
30	9.0	8.6	8.3	8.0	7.9

For load of 350 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 175 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	15 Inch Beam, Heavy Section.				
	100 lbs.	95 lbs.	90 lbs.	85 lbs.	80 lbs.
10	73.1	70.8	68.6	66.4	64.0
11	60.4	58.6	54.7	54.9	53.0
12	50.7	49.2	47.7	46.1	44.5
13	43.2	41.9	40.6	39.2	37.9
14	37.4	36.2	35.0	33.9	32.7
15	32.5	31.5	30.5	29.5	28.5
16	28.6	27.7	26.8	25.9	25.0
17	25.3	24.5	23.8	23.0	22.2
18	22.6	21.9	21.2	20.5	19.8
19	20.2	19.6	19.0	18.4	17.8
20	18.3	17.7	17.1	16.6	16.0
21	16.6	16.0	15.5	15.0	14.5
22	15.1	14.6	14.2	13.7	13.2
23	13.8	13.4	12.9	12.5	12.1
24	12.7	12.3	11.9	11.5	11.1
25	11.7	11.3	11.0	10.6	10.3
26	10.8	10.5	10.1	9.8	9.5
27	10.0	9.7	9.4	9.1	8.8
28	9 3	9.0	8.7	8.5	8.2
29	8.7	8.4	8.2	7.9	7.6
30	8.1	7.9	7.6	7.4	7.1

For load of 350 lbs. per square foot, divide the spacing given by 2.
Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 175 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	15 Inch Beam, Light Section.				
	80 lbs.	75 lbs.	70 lbs.	65 lbs.	60 lbs.
10	58.5	56.2	54.0	51.7	49.5
11	48.3	46.5	44.6	42.7	40.9
12	40.6	39.0	37.5	35.9	34.3
13	34.5	33.2	31.9	30.6	29.3
14	29.8	28.7	27.5	26.4	25.3
15	26.0	25.0	24.0	23.0	22.0
16	22.8	21.9	21.1	20.2	19.3
17	20.2	19.4	18.7	17.9	17.1
18	18.1	17.4	16.7	15.9	15.2
19	16.2	15.6	15.0	14.3	13.7
20	14.6	14.1	13.5	12.9	12.3
21	13.2	12.7	12.2	11.7	11.2
22	12.1	11.6	11.1	10.7	10.2
23	11.0	10.6	10.2	9.8	9.4
24	10.2	9.8	9.4	9.0	8.6
25	9.4	9.0	8.6	8.3	7.9
26	8.6	8.3	8.0	7.7	7.3
27	8.0	7.7	7.4	7.1	6.8
28	7.4	7.1	6.9	6.6	6.3
29	7.0	6.7	6.5	6.2	5.9
30	6.5	6.2	6.0	5.8	5.5

For load of 350 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 175 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	15 Inch Beam, Standard.				
	60 lbs.	55 lbs.	50 lbs.	45 lbs.	42 lbs.
10	43.9	41.7	39.5	37.3	35.9
11	36.3	34.5	32.6	30.8	29.7
12	30.5	29.0	27.4	25.9	24.9
13	26.0	24.7	23.4	22.1	21.3
14	22.5	21.3	20.2	19.0	18.3
15	19.5	18.5	17.5	16.6	15.9
16	17.1	16.3	15.4	14.6	14.0
17	15.2	14.5	13.7	12.9	12.4
18	13.5	12.9	12.2	11.5	11.1
19	12.2	11.5	10.9	10.3	9.9
20	11.0	10.5	9.9	9.3	9.0
21	10.0	9.5	9.0	8.5	8.1
22	9.1	8.6	8.2	7.7	7.4
23	8.3	7.9	7.5	7.0	6.8
24	7.7	7.3	6.9	6.5	6.2
25	7.1	6.7	6.3	5.9	5.7
26	6.5	6.2	5.8	5.5	5.3
27	6.0	5.7	5.4	5.1	4.9
28	5.6	5.3	5.0	4.7	4.6
29	5.2	5.0	4.7	4.4	4.3
30	4.9	4.6	4.4	4.1	4.0

For load of 350 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 175 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	12 Inch Beam, Special Section.				12 Inch Beam, Standard.		
	55 lbs.	50 lbs.	45 lbs.	40 lbs.	40 lbs.	35 lbs.	31.5 lbs.
10	32.7	30.9	29.1	27.3	24.9	23.2	21.9
11	27.0	25.5	24.1	22.6	20.6	19.1	18.1
12	22.7	21.5	20.2	19.0	17.3	16.1	15.2
13	19.4	18.3	17.2	16.2	14.8	13.7	13.0
14	16.7	15.8	14.9	13.9	12.8	11.8	11.2
15	14.5	13.7	12.9	12.1	11.1	10.3	9.8
16	12.7	12.1	11.4	10.7	9.8	9.0	8.6
17	11.3	10.7	10.1	9.4	8.6	8.0	7.6
18	10.1	9.5	9.0	8.4	7.7	7.1	6.7
19	9.1	8.6	8.1	7.5	6.9	6.4	6.1
20	8.2	7.7	7.3	6.8	6.2	5.8	5.5
21	7.4	7.0	6.6	6.2	5.7	5.3	5.0
22	6.7	6.4	6.0	5.7	5.1	4.8	4.5
23	6.2	5.8	5.5	5.1	4.7	4.4	4.2
24	5.7	5.4	5.0	4.7	4.3	4.0	3.8
25	5.3	5.0	4.7	4.3	4.0	3.7	3.5
26	4.9	4.6	4.3	4.1	3.7	3.4	3.3
27	4.5	4.2	4.0	3.8	3.4	3.2	3.0
28	4.2	3.9	3.7	3.5	3.2	3.0	2.8
29	3.9	3.7	3.5	3.3	3.0	2.7	2.6
30	3.6	3.4	3.2	3.0	2.7	2.6	2.5

For load of 350 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 175 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	10 Inch Beam, Standard.				9 Inch Beam, Standard.			
	40 lbs.	35 lbs.	30 lbs.	25 lbs.	35 lbs.	30 lbs.	25 lbs.	21 lbs.
10	19.4	17.9	16.4	14.9	15.3	13.9	12.6	11.5
11	16.0	14.8	13.5	12.3	12.6	11.5	10.4	9.5
12	13.4	12.4	11.4	10.3	10.6	9.7	8.7	8.0
13	11.4	10.6	9.7	8.8	9.0	8.2	7.4	6.8
14	9.9	9.1	8.3	7.6	7.8	7.1	6.4	5.9
15	8.6	7.9	7.3	6.6	6.8	6.2	5.6	5.1
16	7.5	7.0	6.4	5.7	5.9	5.4	4.9	4.5
17	6.7	6.2	5.7	5.1	5.3	4.8	4.3	4.0
18	6.0	5.5	5.0	4.6	4.7	4.3	3.9	3.5
19	5.4	5.0	4.5	4.1	4.2	3.8	3.5	3.2
20	4.9	4.5	4.1	3.7	3.8	3.5	3.1	2.9
21	4.4	4.1	3.7	3.4	3.5	3.1	2.8	2.6
22	4.0	3.7	3.4	3.1	3.1	2.9	2.6	2.4
23	3.7	3.4	3.1	2.8	2.8	2.6	2.4	2.2
24	3.4	3.1	2.9	2.6	2.6	2.4	2.2	2.0
25	3.1	2.9	2.6	2.4	2.4	2.2	2.0	1.8
26	2.9	2.6	2.4	2.2	2.3	2.1	1.9	1.7
27	2.6	2.4	2.2	2.1	2.1	1.9	1.7	1.6
28	2.5	2.3	2.1	1.9	1.9	1.8	1.6	1.5
29	2.3	2.1	1.9	1.8	1.8	1.7	1.5	1.4
30	2.2	2.0	1.8	1.7	1.7	1.5	1.4	1.3

For load of 350 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 175 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	8 Inch Beam, Standard.				7 Inch Beam, Standard.		
	25¼ lbs.	22¾ lbs.	20¼ lbs.	17¾ lbs.	20 lbs.	17½ lbs.	15 lbs.
5	41.8	39.4	37.0	34.7	29.4	27.3	25.3
6	29.1	27.4	25.7	24.1	20.5	19.0	17.5
7	21.4	20.1	18.9	17.7	15.0	13.9	12.9
8	16.3	15.4	14.5	13.5	11.5	10.7	9.8
9	12.9	12.2	11.4	10.7	9.1	8.5	7.8
10	10.5	9.9	9.3	8.7	7.4	6.9	6.3
11	8.6	8.2	7.7	7.1	6.1	5.7	5.2
12	7.3	6.9	6.5	6.0	5.1	4.7	4.4
13	6.2	5.8	5.5	5.1	4.3	4.1	3.7
14	5.3	5.0	4.7	4.4	3.8	3.5	3.2
15	4.6	4.4	4.1	3.8	3.3	3.0	2.8
16	4.1	3.8	3.6	3.4	2.9	2.7	2.5
17	3.6	3.4	3.2	3.0	2.6	2.4	2.3
18	3.2	3.0	2.9	2.7	2.3	2.1	1.9
19	2.9	2.7	2.6	2.4	2.0	1.9	1.8
20	2.6	2.5	2.3	2.2	1.8	1.7	1.6
21	2.4	2.2	2.1	1.9	1.7	1.5	1.4
22	2.2	2.1	1.9	1.8	1.5	1.4	1.3

For load of 350 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 175 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	6 Inch Beam, Standard.			5 Inch Beam, Standard.		
	17¼ lbs.	14¾ lbs.	12¼ lbs.	14¾ lbs.	12¼ lbs.	9¾ lbs.
5	21.3	19.5	17.7	14.8	13.3	11.8
6	14.8	13.5	12.3	10.3	9.2	8.2
7	10.9	9.9	9.0	7.5	6.8	6.0
8	8.3	7.6	6.9	5.8	5.2	4.6
9	6.6	6.0	5.4	4.6	4.1	3.7
10	5.3	4.9	4.4	3.7	3.3	3.0
11	4.4	4.1	3.7	3.0	2.7	2.5
12	3.7	3.4	3.1	2.6	2.3	2.1
13	3.1	2.9	2.6	2.2	1.9	1.7
14	2.7	2.5	2.3	1.9	1.7	1.5
15	2.4	2.2	1.9	1.7	1.5	1.3
16	2.1	1.9	1.7	1.4	1.3	1.1
17	1.8	1.7	1.5	1.3	1.1	1.0
18	1.7	1.5	1.4	1.1	1.0	0.9
19	1.5	1.4	1.2	1.0		
20	1.3	1.2	1.1			
21	1.2	1.1	1.0			
22	1.1	1.0	0.9			

For load of 350 lbs. per square foot, divide the spacing given by 2.
Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 175 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	4 Inch Beam, Standard.				3 Inch Beam, Standard.		
	10½ lbs.	9½ lbs.	8½ lbs.	7½ lbs.	7½ lbs.	6½ lbs.	5½ lbs.
5	8.7	8.2	7.8	7.5	4.7	4.4	4.0
6	6.1	5.7	5.4	5.0	3.3	3.0	2.8
7	4.4	4.2	3.9	3.7	2.4	2.3	2.1
8	3.4	3.2	3.0	2.9	1.8	1.7	1.5
9	2.7	2.5	2.4	2.2	1.5	1.4	1.3
10	2.2	2.1	1.9	1.8	1.2	1.1	1.0
11	1.8	1.7	1.6	1.5	1.0	.....	.....
12	1.5	1.4	1.3	1.2	.....	.....	.....
					.....	.....	.....
13	1.4	1.3	1.1	1.1	.....	.....	.....
14	1.1	1.0	1.0	0.9	.....	.....	.....
15	1.0	.....	.....	.....	.....	.....	.....

For load of 350 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 150 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	24 Inch Beam, Standard.				
	100 lbs.	95 lbs.	90 lbs.	85 lbs.	80 lbs.
10	140.4	136.3	132.1	127.9	123.7
11	116.1	112.6	109.1	105.7	102.2
12	97.5	94.6	91.7	88.8	85.9
13	83.1	80.6	78.1	75.7	73.2
14	71.6	69.5	67.4	65.3	63.1
15	62.4	60.5	58.7	56.8	55.0
16	54.7	53.2	51.6	49.9	48.3
17	48.6	47.1	45.7	44.3	42.8
18	43.3	42.0	40.7	39.5	38.3
19	38.9	37.7	36.6	35.4	34.3
20	35.1	34.1	33.0	32.0	30.9
21	31.8	30.9	29.9	29.0	28.1
22	29.0	28.1	27.3	26.4	25.5
23	26.5	25.7	24.9	24.2	23.4
24	24.4	23.7	22.9	22.2	21.5
25	22.5	21.8	21.1	20.5	19.8
26	20.7	20.1	19.5	18.9	18.3
27	19.3	18.7	18.1	17.5	17.0
28	17.9	17.4	16.9	16.3	15.8
29	16.7	16.2	15.7	15.2	14.7
30	15.6	15.1	14.7	14.2	13.7

For load of 300 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 150 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	20 Inch Beam, Heavy Section.				
	100 lbs.	95 lbs.	90 lbs.	85 lbs.	80 lbs.
10	118.2	114.7	111.3	107.7	104.3
11	97.3	94.5	91.8	88.9	86.2
12	82.1	79.7	77.3	74.8	72.4
13	69.9	67.9	65.8	63.7	61.7
14	60.3	58.5	56.7	55.0	53.2
15	52.5	51.0	49.5	47.9	46.3
16	46.2	44.8	43.5	42.1	40.7
17	40.9	39.7	38.5	37.3	36.1
18	36.5	35.4	34.3	33.3	32.2
19	32.7	31.8	30.8	29.9	28.9
20	29.5	28.7	27.8	26.9	26.1
21	26.8	26.0	25.2	24.4	23.6
22	24.4	23.7	23.0	22.3	21.6
23	22.3	21.7	21.0	20.4	19.7
24	20.5	19.9	19.3	18.7	18.1
25	18.9	18.3	17.8	17.3	16.7
26	17.5	16.9	16.4	15.9	15.4
27	16.2	15.7	15.3	14.8	14.3
28	15.1	14.6	14.2	13.7	13.3
29	14.1	13.6	13.2	12.8	12.4
30	13.1	12.7	12.3	11.9	11.6

For load of 300 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 160 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	20 Inch Beam, Standard.				
	80 lbs.	75 lbs.	70 lbs.	65 lbs.	64 lbs.
10	94.3	90.9	87.3	83.9	83.1
11	77.9	75.1	72.2	69.3	68.7
12	65.5	63.1	60.7	58.2	57.7
13	55.8	53.7	51.7	49.6	49.2
14	48.1	46.3	44.5	42.8	42.4
15	41.9	40.4	38.8	37.3	36.9
16	36.9	35.5	34.1	32.7	32.5
17	32.6	31.4	30.2	29.0	28.8
18	29.1	28.1	26.9	25.9	25.7
19	26.1	25.1	24.2	23.2	23.1
20	23.6	22.7	21.8	20.9	20.8
21	21.4	20.6	19.8	19.0	18.9
22	19.5	18.7	18.1	17.3	17.2
23	17.8	17.2	16.5	15.9	15.7
24	16.4	15.8	15.2	14.5	14.4
25	15.1	14.5	14.0	13.4	13.3
26	13.9	13.4	12.9	12.4	12.3
27	12.9	12.5	12.0	11.5	11.4
28	12.0	11.6	11.2	10.7	10.6
29	11.2	10.8	10.4	10.0	9.9
30	10.5	10.1	9.7	9.3	9.2

For load of 300 lbs. per square foot, divide the spacing given by 2.
Maximum fiber strain, 16,000 lbs. per square inch

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 150 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	15 Inch Beam, Heavy Section.				
	100 lbs.	95 lbs.	90 lbs.	85 lbs.	80 lbs.
10	85.8	82.7	80.1	77.5	74.8
11	70.5	68.3	66.1	64.0	61.8
12	59.2	57.4	55.6	53.8	51.9
13	50.5	48.9	47.3	45.7	44.2
14	43.5	42.2	40.9	39.5	38.2
15	37.9	36.7	35.6	34.4	33.3
16	33.3	32.2	31.2	30.2	29.2
17	29.5	28.6	27.7	26.8	25.9
18	26.3	25.5	24.7	23.9	23.1
19	23.6	22.9	22.2	21.5	20.7
20	21.3	20.7	20.0	19.3	18.7
21	19.3	18.7	18.1	17.5	16.9
22	17.6	17.1	16.5	16.0	15.5
23	16.1	15.6	15.1	14.6	14.1
24	14.8	14.3	13.9	13.5	13.0
25	13.6	13.2	12.8	12.4	12.0
26	12.6	12.2	11.8	11.4	11.1
27	11.7	11.3	11.0	10.6	10.3
28	10.9	10.5	10.2	9.9	9.5
29	10.1	9.8	9.5	9.2	8.9
30	9.5	9.2	8.9	8.6	8.3

For load of 300 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 150 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	15 Inch Beam, Light Section.				
	80 lbs.	75 lbs.	70 lbs.	65 lbs.	60 lbs.
10	68.2	65.6	63.0	60.3	57.7
11	56.3	54.2	52.1	49.9	47.7
12	47.3	45.5	43.7	41.9	40.1
13	40.3	38.8	37.3	35.7	34.1
14	34.8	33.5	32.1	30.8	29.5
15	30.3	29.1	28.0	26.9	25.7
16	26.6	25.6	24.6	23.6	22.5
17	23.5	22.7	21.8	20.9	20.0
18	21.1	20.3	19.4	18.6	17.8
19	18.9	18.2	17.5	16.7	16.0
20	17.1	16.4	15.7	15.1	14.4
21	15.5	14.9	14.3	13.7	13.1
22	14.1	13.5	13.0	12.5	11.9
23	12.9	12.4	11.9	11.4	10.9
24	11.9	11.4	10.9	10.5	10.0
25	10.9	10.5	10.1	9.7	9.3
26	10.1	9.7	9.3	8.9	8.5
27	9.3	9.0	8.6	8.3	7.9
28	8.7	8.3	8.0	7.7	7.3
29	8.1	7.8	7.5	7.2	6.9
30	7.6	7.3	7.0	6.7	6.4

For load of 300 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 150 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	15 Inch Beam, Standard.				
	60 lbs.	55 lbs.	50 lbs.	45 lbs.	42 lbs.
10	51.3	48.7	46.1	43.6	41.9
11	42.4	40.2	38.1	35.9	34.6
12	35.6	33.8	32.0	30.2	29.1
13	30.3	28.8	27.3	25.7	24.7
14	26.2	24.9	23.5	22.2	21.4
15	22.8	21.6	20.5	19.3	18.6
16	20.0	19.0	18.0	17.0	16.3
17	17.7	16.8	15.9	15.0	14.5
18	15.8	15.0	14.2	13.4	12.9
19	14.2	13.5	12.7	12.1	11.6
20	12.9	12.2	11.5	10.9	10.5
21	11.7	11.1	10.5	9.9	9.5
22	10.6	10.1	9.5	9.0	8.7
23	9.7	9.2	8.7	8.2	7.9
24	8.9	8.5	8.0	7.5	7.3
25	8.3	7.8	7.4	6.9	6.7
26	7.6	7.2	6.8	6.4	6.2
27	7.0	6.7	6.3	5.9	5.7
28	6.5	6.2	5.9	5.5	5.3
29	6.1	5.8	5.5	5.1	5.0
30	5.7	5.4	5.1	4.8	4.6

For load of 300 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 150 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	12 Inch Beam, Special Section.				12 Inch Beam, Standard.		
	55 lbs.	50 lbs.	45 lbs.	40 lbs.	40 lbs.	35 lbs.	31½ lbs.
10	38.1	36.1	34.0	31.9	29.1	27.1	25.6
11	31.5	29.8	28.1	26.3	24.1	22.3	21.1
12	26.5	25.1	23.6	22.1	20.2	18.8	17.7
13	22.6	21.3	20.1	18.9	17.3	16.0	15.1
14	19.5	18.4	17.3	16.3	14.9	13.8	13.1
15	16.9	16.0	15.1	14.1	12.9	12.0	11.4
16	14.9	14.1	13.3	12.5	11.4	10.5	10.0
17	13.2	12.5	11.7	11.0	10.1	9.3	8.9
18	11.8	11.1	10.5	9.8	9.0	8.3	7.9
19	10.6	10.0	9.4	8.8	8.1	7.5	7.1
20	9.5	9.0	8.5	7.9	7.3	6.7	6.4
21	8.7	8.2	7.7	7.2	6.6	6.1	5.8
22	7.9	7.5	7.0	6.6	6.0	5.6	5.3
23	7.2	6.8	6 4	6.0	5.5	5.1	4.9
24	6.6	6.3	5.9	5.5	5.1	4.7	4.4
25	6.1	5.8	5.5	5.1	4.7	4.3	4.1
26	5.7	5.3	5.0	4.7	4.3	4.0	3.8
27	5.3	4.9	4.7	4.4	4.0	3.7	3.5
28	4.9	4.6	4.3	4.1	3.7	3.5	3.3
29	4.5	4.3	4.1	3.8	3.5	3.2	3.1
30	4.2	4.0	3.7	3.5	3.2	3.0	2.9

For load of 300 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 150 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	10 Inch Beam, Standard.				9 Inch Beam, Standard.			
	40 lbs.	35 lbs.	30 lbs.	25 lbs.	35 lbs.	30 lbs.	25 lbs.	21 lbs.
10	22.6	20.9	19.1	17.3	17.8	16.3	14.7	13.4
11	18.7	17.3	15.8	14.3	14.7	13.4	12.1	11.1
12	15.7	14.5	13.3	12.1	12.3	11.3	10.2	9.3
13	13.3	12.3	11.3	10.3	10.5	9.6	8.7	7.9
14	11.5	10.6	9.7	8.9	9.1	8.3	7.5	6.9
15	10.1	9.3	8.5	7.7	7.9	7.2	6.5	5.9
16	8.8	8.1	7.5	6.8	6.9	6.3	5.7	5.3
17	7.8	7.2	6.6	6.0	6.1	5.6	5.1	4.7
18	7.0	6.5	5.9	5.3	5.5	5.0	4.5	4.1
19	6.3	5.8	5.3	4.8	4.9	4.5	4.1	3.7
20	5.7	5.2	4.8	4.3	4.5	4.1	3.7	3.3
21	5.1	4.7	4.3	3.9	4.1	3.7	3.3	3.1
22	4.7	4.3	3.9	3.6	3.7	3.3	3.0	2.8
23	4.3	3.9	3.6	3.3	3.3	3.1	2.8	2.5
24	3.9	3.6	3.3	3.0	3.1	2.8	2.5	2.3
25	3.6	3.3	3.1	2.8	2.9	2.6	2.3	2.1
26	3.3	3.1	2.8	2.5	2.7	2.4	2.2	2.0
27	3.1	2.9	2.6	2.4	2.5	2.2	2.0	1.9
28	2.9	2.7	2.4	2.2	2.3	2.1	1.9	1.7
29	2.7	2.5	2.3	2.1	2.1	1.9	1.7	1.6
30	2.5	2.3	2.1	1.9	2.0	1.8	1.6	1.5

For load of 300 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 150 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	8 Inch Beam, Standard.				7 Inch Beam, Standard.		
	25¼ lbs.	22¾ lbs.	20½ lbs.	17¾ lbs.	20 lbs.	17½ lbs.	15 lbs.
5	48.8	46.0	43.2	40.5	34.3	31.9	29.5
6	33.9	31.9	30.0	28.1	23.8	22.1	20.5
7	24.9	23.5	22.1	20.6	17.5	16.3	15.0
8	19.1	18.0	16.9	15.8	13.4	12.5	11.5
9	15.1	14.2	13.3	12.5	10.6	9.9	9.1
10	12.2	11.5	10.8	10.1	8.6	8.0	7.3
11	10.1	9.5	8.9	8.3	7.1	6.6	6.1
12	8.5	8.0	7.5	7.0	5.9	5.5	5.1
13	7.2	6.8	6.4	6.0	5.1	4.7	4.3
14	6.2	5.9	5.5	5.1	4.4	4.1	3.7
15	5.4	5.1	4.8	4.5	3.8	3.5	3.3
16	4.7	4.5	4.2	3.9	3.3	3.1	2.9
17	4.2	4.0	3.7	3.5	3.0	2.7	2.5
18	3.7	3.5	3.3	3.1	2.7	2.5	2.3
19	3.4	3.2	3.0	2.8	2.3	2.2	2.1
20	3.1	2.9	2.7	2.5	2.1	2.0	1.9
21	2.8	2.6	2.5	2.3	1.9	1.8	1.7
22	2.5	2.4	2.2	2.1	1.8	1.7	1.5

For load of 300 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 150 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	6 Inch Beam, Standard.			5 Inch Beam, Standard.		
	17¼ lbs.	14¾ lbs.	12¼ lbs.	14¾ lbs.	12¼ lbs.	9¾ lbs.
5	24.8	22.7	20.7	17.3	15.5	13.7
6	17.3	15.8	14.3	12.0	10.7	9.5
7	12.7	11.6	10.5	8.8	7.9	7.0
8	9.7	8.9	8.1	6.7	6.1	5.4
9	7.7	7.0	6.3	5.3	4.8	4.3
10	6.2	5.7	5.1	4.3	3.9	3.5
11	5.1	4.7	4.3	3.5	3.2	2.9
12	4.3	3.9	3.6	3.0	2.7	2.4
13	3.6	3.3	3.1	2.5	2.3	2.0
14	3.2	2.9	2.7	2.2	2.0	1.7
15	2.7	2.5	2.3	1.9	1.7	1.5
16	2.4	2.2	2.0	1.7	1.5	1.3
17	2.1	1.9	1.8	1.5	1.3	1.2
18	1.9	1.7	1.6	1.3	1.2	1.1
19	1.7	1.6	1.4	1.2	1.1	0.9
20	1.5	1.4	1.3	1.1	1.0	.....
21	1.4	1.3	1.2	1.0	.....	.....
22	1.3	1.2	1.1	.....	.....	.....

For load of 300 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 160 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	4 Inch Beam, Standard.				3 Inch Beam, Standard.		
	10½ lbs.	9½ lbs.	8½ lbs.	7½ lbs.	7½ lbs.	6½ lbs.	5½ lbs.
5	10.1	9.6	9.1	8.5	5.5	5.1	4.7
6	7.1	6.7	6.3	5.9	3.9	3.5	3.2
7	5.2	4.9	4.6	4.3	2.8	2.6	2.4
8	3.9	3.7	3.5	3.3	2.1	2.0	1.8
9	3.1	2.9	2.8	2.6	1.7	1.6	1.5
10	2.5	2.4	2.3	2.1	1.4	1.3	1.2
11	2.1	2.0	1.9	1.7	1.1	1.1	1.0
12	1.7	1.7	1.6	1.5	0.9	0.9	.....
13	1.5	1.4	1.3	1.2	.....	.....	.....
14	1.3	1.2	1.1	1.1	.....	.....	.....
15	1.1	1.1	1.0	0.9	.....	.....	.....
16	1.0	.....	.....	.....	.....	.....	.....

For load of 300 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 125 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	24 Inch Beam, Standard.				
	100 lbs.	95 lbs.	90 lbs.	85 lbs.	80 lbs.
10	168.5	163.5	158.5	153.5	148.4
11	139.3	135.1	131.0	126.8	122.6
12	117.0	113.5	110.0	106.5	103.0
13	99.7	96.7	93.7	90.8	87.8
14	86.0	83.4	80.9	78.3	75.9
15	74.9	72.6	70.4	68.2	66.0
16	65.7	63.8	61.9	59.9	51.7
17	58.3	56.6	54.8	53.1	51.3
18	52.0	50.5	48.9	47.4	45.9
19	46.6	45.3	43.9	42.5	41.1
20	42.2	40.9	39.6	38.4	37.1
21	38.2	37.1	35.9	34.8	33.7
22	34.8	33.8	32.7	31.7	30.6
23	31.8	30.9	29.9	29.0	28.1
24	29.3	28.4	27.5	26.6	25.7
25	27.0	26.2	25.4	24.6	23.8
26	24.9	24.2	23.4	22.7	21.9
27	23.1	22.4	21.7	21.0	20.4
28	21.5	20.9	20.2	19.6	19.0
29	20.0	19.4	18.8	18.2	17.7
30	18.7	18.2	17.6	17.0	16.5

For load of 250 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 125 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	15 Inch Beam, Heavy Section.				
	100 lbs.	95 lbs.	90 lbs.	85 lbs.	80 lbs.
10	102.3	99.2	96.1	93.0	89.7
11	84.6	82.0	79.4	76.8	74.2
12	71.0	68.9	66.7	64.5	62.3
13	60.6	58.7	56.8	54.9	53.1
14	52.2	50.6	49.0	47.4	45.8
15	45.5	44.1	42.7	41.3	39.9
16	40.0	38.7	37.5	36.3	35.0
17	35.4	34.3	33.3	32.2	31.1
18	31.6	30.6	29.7	28.6	27.7
19	28.3	27.4	26.6	25.8	24.9
20	25.6	24.8	24.0	23.2	22.4
21	23.2	22.5	21.7	21.0	20.3
22	21.1	20.5	19.8	19.2	18.6
23	19.3	10.7	18.1	17.5	17.0
24	17.7	17.2	16.6	16.1	15.6
25	16.4	15.9	15.4	14.9	14.4
26	15.1	14.6	14.2	13.7	13.3
27	14.0	13.6	13.2	12.7	12.3
28	13.0	12.6	12.2	11.8	11.4
29	12.2	11.8	11.4	11.0	10.6
30	11.4	11.0	10.7	10.3	10.0

For load of 250 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 125 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	20 Inch Beam, Standard.				
	80 lbs.	75 lbs.	70 lbs.	65 lbs.	64 lbs.
10	113.2	109.0	104.8	100.6	99.8
11	93.5	90.1	86.6	83.2	82.5
12	78.6	75.8	72.9	69.8	69.3
13	67.0	64.5	62.0	59.5	59.0
14	57.7	55.6	53.5	51.4	50.9
15	50.3	48.5	46.6	44.7	44.3
16	44.2	42.6	41.0	39.3	38.9
17	39.1	37.7	36.2	34.8	34.6
18	35.0	33.7	32.3	31.0	30.8
19	31.4	30.2	29.0	27.8	27.7
20	28.3	27.3	26.2	25.1	25.0
21	25.7	24.7	23.8	22.8	22.6
22	23.4	22.5	21.7	20.8	20.6
23	21.4	20.6	19.8	19.0	18.9
24	19.7	19.0	18.2	17.4	17.3
25	18.1	17.4	16.8	16.1	16.0
26	16.7	16.1	15.5	14.9	14.7
27	15.5	15.0	14.4	13.8	13.7
28	14.4	13.9	13.4	12.9	12.7
29	13.4	13.0	12.5	12.0	11.8
30	12.6	12.1	11.6	11.2	11.0

For load of 250 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 125 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	20 Inch Beam, Heavy Section.				
	100 lbs.	95 lbs.	90 lbs.	85 lbs.	80 lbs.
10	141.8	137.7	133.5	129.3	125.1
11	117.2	113.8	110.3	106.9	103.4
12	98.5	95.6	92.7	89.8	86.9
13	83.9	81.4	79.0	76 5	74.0
14	72.4	70.2	68.1	66.0	63.8
15	63.0	61.2	59.3	57.4	55.6
16	55.4	53.8	52.2	50.5	48.9
17	49.1	47.6	46.2	44.7	43.3
18	43.8	42.5	41.2	39.9	38.6
19	39.3	38.2	37.0	35.8	34.6
20	35.4	34.4	33.4	32.3	31.3
21	32.2	31.2	30.2	29.3	28.3
22	29.3	28.4	27.6	26.7	25.9
23	26.8	26.0	25.2	24.5	23.7
24	24.6	23.9	23.2	22.4	21.7
25	22.7	22.0	21.4	20.7	20.0
26	20.9	20.3	19.7	19.1	18.5
27	19.4	18.9	18.3	17.8	17.2
28	18.1	17.5	17.0	16.5	15.9
29	16.9	16.3	15.8	15.4	14.9
30	15.8	15.3	14.8	14.3	13.9

For load of 250 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 125 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	15 Inch Beam, Light Section.				
	80 lbs.	75 lbs.	70 lbs.	65 lbs.	60 lbs.
10	81.8	78.7	75.6	72.4	69.3
11	67.6	65.0	62.5	69.9	57.3
12	56.8	54.6	52.5	50.3	48.1
13	48.4	46.5	44.7	42.9	41.0
14	41.8	40.2	38.6	37.0	35.4
15	36.4	34.9	33.6	32.2	30.8
16	32.0	30.7	29.5	28.3	27.0
17	28.2	27.2	26.1	25.0	24.0
18	25.3	24.3	23.3	22.3	21.3
19	22.6	21.8	21.0	20.1	19.2
20	20.5	19.7	18.9	18.1	17.3
21	18.6	17.8	17.1	16.4	15.7
22	16.9	16.2	15.6	15.0	14.3
23	15.4	14.9	14.3	13.7	13.1
24	14.2	13.7	13.1	12.6	12.0
25	13.1	12.6	12.1	11.6	11.1
26	12.1	11.6	11.2	10.7	10.2
27	11.2	10.8	10.3	9.9	9.5
28	10.4	10.0	9.6	9.2	8.8
29	9.8	9.4	9.0	8.6	8.2
30	9.1	8.7	8.4	8.1	7.7

For load of 250 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 125 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	15 Inch Beam, Standard				
	60 lbs.	55 lbs.	50 lbs.	45 lbs.	42 lbs.
10	61.5	58.4	55.8	52.2	50.2
11	50.9	48.2	45.7	43.1	41.5
12	42.7	40.6	38.4	36.2	34.9
13	36.4	34.6	32.7	30.9	29.8
14	31.4	29.8	28.2	26.6	25.7
15	27.4	25.9	24.6	23.2	22.3
16	24.0	22.8	21.6	20.4	19.6
17	21.3	20.2	19.1	18.0	17.4
18	19.0	18.0	17.0	16.1	15.5
19	17.0	16.2	15.3	14.5	13.9
20	15.4	14.6	13.8	13.0	12.6
21	14.0	13.3	12.6	11.8	11.4
22	12.7	12.1	11.4	10.8	10.4
23	11.7	11.1	10.5	9.8	9.5
24	10.7	10.2	9.6	9.0	8.7
25	9.9	9.4	8.9	8.3	8.0
26	9.1	8.6	8.2	7.7	7.4
27	8.4	8.0	7.6	7.1	6.9
28	7.8	7.4	7.0	6.6	6.4
29	7.3	7.0	6.6	6.2	6.0
30	6.8	6.5	6.1	5.8	5.6

For load of 250 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 125 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	12 Inch Beam, Special Section.				12 Inch Beam, Standard.		
	55 lbs.	50 lbs.	45 lbs.	40 lbs.	40 lbs.	35 lbs.	31½ lbs.
10	45.8	43.3	40.8	38.2	35.0	32.5	30.7
11	37.8	35.8	33.7	31.6	28.9	26.8	25.4
12	31.8	30.1	28.3	26.6	24.2	22.6	21.3
13	27.1	25.6	24.2	22.6	20.7	19.2	18.2
14	23.4	22.1	20.8	19.5	17.8	16.6	15.7
15	20.3	19.2	18.1	17.0	15.5	14.4	13.7
16	17.8	16.9	15.9	15.0	13.7	12.6	12.0
17	15.8	15.0	14.1	13.2	12.1	11.2	10.6
18	14.2	13.4	12.6	11.8	10.8	10.0	9.4
19	12.7	12.0	11.3	10.6	9.7	9.0	8.5
20	11.4	10.8	10.2	9.5	8.7	8.1	7.7
21	10.4	9.8	9.2	8.6	7.9	7.4	7.0
22	9.4	8.9	8.4	7.9	7.2	6.7	6.3
23	8.6	8.2	7.7	7.2	6.6	6.2	5.8
24	7.9	7.5	7.0	6.6	6.1	5.6	5.3
25	7.4	7.0	6.6	6.1	5.6	5.2	4.9
26	6.8	6.4	6.0	5.7	5.2	4.8	4.6
27	6.2	5.9	5.6	5.3	4.8	4.5	4.2
28	5.8	5.5	5.2	4.9	4.5	4.2	3.9
29	5.4	5.2	4.9	4.6	4.1	3.8	3.7
30	5.0	4.8	4.5	4.2	3.8	3.6	3.4

For load of 250 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 125 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	10 Inch Beam. Standard.				9 Inch Beam, Standard.			
	40 lbs.	35 lbs.	30 lbs.	25 lbs.	35 lbs.	30 lbs.	25 lbs.	21 lbs.
10	27.1	25.0	22.9	20.8	21.4	19.5	17.6	16.1
11	22.4	20.7	18.9	17.2	17.7	16.1	14.6	13.3
12	18.8	17.3	15.9	14.5	14.8	13.5	12.2	11.2
13	16.0	14.8	13.6	12.3	12.6	11.5	10.4	9.5
14	13.6	12.8	11.7	10.6	10.9	9.9	9.0	8.2
15	12.1	11.1	10.2	9.3	9.5	8.6	7.8	7.1
16	10.6	9.8	9.0	8.2	8.3	7.6	6.9	6.3
17	9.3	8.6	7.9	7.2	7.4	6.7	6.1	5.6
18	8.4	7.7	7.0	6.4	6.6	6.0	5.4	5.0
19	7.5	6.9	6.3	5.7	5.9	5.4	4.9	4.5
20	6.8	6.2	5.7	5.2	5.4	4.9	4.4	4.0
21	6.2	5.7	5.2	4.7	4.9	4.4	4.0	3.7
22	5.6	5.2	4.7	4.3	4.4	4.0	3.6	3.3
23	5.1	4.7	4.3	3.9	4.0	3.7	3.4	3.0
24	4.7	4.3	4.0	3.6	3.7	3.4	3.0	2.8
25	4.3	4.0	3.7	3.4	3.4	3.1	2.8	2.6
26	4.0	3.7	3.4	3.0	3.2	2.9	2.6	2.4
27	3.7	3.4	3.1	2.9	2.9	2.6	2.4	2.2
28	3.4	3.2	2.9	2.6	2.7	2.5	2.2	2.1
29	3.2	2.9	2.7	2.5	2.6	2.3	2.1	1.9
30	3.0	2.8	2.6	2.3	2.4	2.2	1.9	1.7

For load of 250 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 125 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	8 Inch Beam, Standard.				7 Inch Beam, Standard.		
	25¼ lbs.	22¾ lbs.	20½ lbs.	17¾ lbs.	20 lbs.	17½ lbs.	15 lbs.
5	58.6	55.2	51.8	48.5	41.2	38.3	35.4
6	40.7	38.3	36.0	33.7	28.6	26.6	24.6
7	29.9	28.2	26.5	24.7	21.0	19.5	18.0
8	22.9	21.6	20.3	19.0	16.1	15.0	13.8
9	18.1	17.0	16.0	14.9	12.7	11.8	10.9
10	14.6	13.8	13.0	12.2	10.3	9.6	8.8
11	12.1	11.4	10.7	10.0	8.5	7.9	7.3
12	10.2	9.6	9.0	8.4	7.1	6.6	6.2
13	8.6	8.2	7.7	7.2	6.1	5.7	5.2
14	7.4	7.0	6.6	6.2	5.3	4.9	4.5
15	6.5	6.2	5.8	5.4	4.6	4.2	3.9
16	5.7	5.4	5.0	4.7	4.0	3.7	3.4
17	5.0	4.8	4.5	4.2	3.6	3.3	3.0
18	4.5	4.2	4.0	3.8	3.2	3.0	2.7
19	4.1	3.8	3.6	3.4	2.8	2.6	2.5
20	3.7	3.4	3.2	3.0	2.6	2.4	2.2
21	3.4	3.1	2.9	2.7	2.3	2.2	2.0
22	3.0	2.8	2.6	2.5	2.2	2.0	1.8

For load of 250 lbs. per square foot, divide the spacing given by 2
Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 125 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	6 Inch Beam, Standard.			5 Inch Beam, Standard.		
	17¼ lbs.	14¾ lbs.	12¼ lbs.	14¾ lbs.	12¼ lbs.	9¾ lbs.
5	29.8	27.3	24.8	20.7	18.6	16.5
6	20.7	19.0	17.2	14.4	12.9	11.4
7	15.2	13.9	12.6	10.5	9.5	8.4
8	11.6	10.6	9.7	8.1	7.3	6.5
9	9.2	8.4	7.6	6.4	5.8	5.1
10	7.4	6.8	6.2	5.2	4.6	4.1
11	6.2	5.7	5.1	4.2	3.8	3.4
12	5.2	4.7	4.3	3.6	3.2	2.9
13	4.3	4.0	3.7	3.0	2.7	2.4
14	3.8	3.5	3.2	2.6	2.4	2.1
15	3.3	3.0	2.7	2.3	2.1	1.8
16	2.9	2.6	2.4	2.0	1.8	1.6
17	2.6	2.3	2.2	1.8	1.6	1.4
18	2.3	2.1	1.9	1.6	1.4	1.3
19	2.1	1.9	1.7	1.4	1.3	1.1
20	1.8	1.7	1.5	1.3	1.1	1.0
21	1.7	1.5	1.4	1.2	1.1	1.0
22	1.5	1.4	1.3	1.0	1.0	0.9

For load of 250 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 125 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	4 Inch Beam, Standard.				3 Inch Beam, Standard.		
	10½ lbs.	9½ lbs.	8½ lbs.	7½ lbs.	7½ lbs.	6½ lbs.	5½ lbs.
5	12.2	11.5	10.9	10.2	6.6	6.1	5.6
6	8.5	8.0	7.5	7.0	4.6	4.2	3.6
7	6.2	5.8	5.5	5.2	3.4	3.2	2.9
8	4.7	4.5	4.2	4.0	2.6	2.4	2.2
9	3.7	3.5	3.3	3.1	2.1	1.9	1.8
10	3.0	2.9	2.7	2.6	1.7	1.5	1.4
11	2.5	2.4	2.2	2.1	1.4	1.3	1.2
12	2.1	2.0	1.8	1.7	1.1	1.0	0.9
13	1.8	1.7	1.6	1.5	1.0	0.9	0.8
14	1.5	1.4	1.4	1.3	.....	.....	.....
15	1.4	1.3	1.2	1.1	.....	.....	.....
16	1.2	1.1	1.0	0.9	.....	.....	.....

For load of 250 lbs. per square foot, divide the spacing given by 2
Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	24 Inch Beam, Standard.				
	100 lbs.	95 lbs.	90 lbs.	85 lbs.	80 lbs.
10	210.6	204.4	198.1	191.8	185.5
11	174.1	168.9	163.7	158.5	153.3
12	146.3	141.9	137.5	133.2	128.8
13	124.6	120.9	117.2	113.5	109.8
14	107.5	104.3	101.1	97.9	94.7
15	93.6	90.8	88.0	85.2	82.5
16	82.3	79.8	77.4	74.9	72.5
17	72.9	70.7	68.5	66.4	64.2
18	65.0	63.1	61.1	59.2	57.4
19	58.3	56.6	54.9	53.1	51.4
20	52.7	51.1	49.5	48.0	46.4
21	47.8	46.3	44.9	43.5	42.1
22	43.5	42.2	40.9	39.6	38.3
23	39.8	38.6	37.4	36.3	35.1
24	36.6	35.5	34.4	33.3	32.2
25	33.7	32.7	31.7	30.7	29.7
26	31.1	30.2	29.3	28.4	27.4
27	28.9	28.0	27.2	26.3	25.5
28	26.9	26.1	25.3	24.5	23.7
29	25.0	24.3	23.6	22.8	22.1
30	23.4	22.7	22.0	21.3	20.6

For load of 200 lbs. per square foot, divide the spacing given by 2.
Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	20 Inch Beam, Heavy Section.				
	100 lbs.	95 lbs.	90 lbs.	85 lbs.	80 lbs.
10	177.3	172.1	166.9	161.6	156.4
11	146.5	142.2	137.9	133.6	129.3
12	123.1	119.5	115.9	112.2	108.6
13	104.9	101.8	98.8	95.7	92.6
14	90.5	87.8	85.1	82.5	79.8
15	78.8	76.5	74.2	71.8	69.5
16	69.3	67.2	65.2	63.1	61.1
17	61.4	59.6	57.8	55.9	54.1
18	54.7	53.1	51.5	49.9	48.3
19	49.1	47.7	46.2	44.8	43.3
20	44.3	43.0	41.7	40.4	39.1
21	40.2	39.0	37.8	36.7	35.5
22	36.6	35.5	34.5	33.4	32.3
23	33.5	32.5	31.5	30.6	29.6
24	30.8	29.9	29.0	28.0	27.1
25	28.4	27.5	26.7	25.9	25.0
26	26.2	25.4	24.7	23.9	23.1
27	24.3	23.6	22.9	22.2	21.5
28	22.6	21.9	21.3	20.6	19.9
29	21.1	20.5	19.8	19.2	18.6
30	19.7	19.1	18.5	18.0	17.4

For load of 200 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	20 Inch Beam, Standard.				
	80 lbs.	75 lbs.	70 lbs.	65 lbs.	64 lbs.
10	141.5	136.3	131.0	125.8	124.7
11	116.9	112.6	108.3	104.0	103.1
12	98.3	94.6	91.0	87.3	86.6
13	83.7	80.6	77.5	74.4	73.8
14	72.2	69.5	66.9	64.2	63.6
15	62.9	60.6	58.2	55.9	55.4
16	55.3	53.2	51.2	49.1	48.7
17	48.9	47.1	45.3	43.5	43.2
18	43.7	42.1	40.4	38.8	38.5
19	39.2	37.7	36.3	34.8	34.6
20	35.4	34.1	32.7	31.4	31.2
21	32.1	30.9	29.7	28.5	28.3
22	29.2	28.1	27.1	26.0	25.8
23	26.7	25.7	24.8	23.8	23.6
24	24.6	23.7	22.8	21.8	21.7
25	22.6	21.8	20.9	20.1	20.0
26	20.9	20.1	19.4	18.6	18.4
27	19.4	18.7	18.0	17.3	17.1
28	18.0	17.3	16.7	16.0	15.9
29	16.8	16.2	15.6	15.0	14.8
30	15.7	15.1	14.6	14.0	13.9

For load of 200 lbs. per square foot, divide the spacing given by 2.
Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	15 Inch Beam, Heavy Section.				
	100 lbs.	95 lbs.	90 lbs.	85 lbs.	80 lbs.
10	127.9	124.0	120.1	116.2	112.2
11	105.7	102.5	99.2	96.0	92.7
12	88.8	86.1	83.4	80.7	77.9
13	75.7	73.4	71.0	68.6	66.4
14	65.3	63.3	61.3	59.3	57.3
15	56.9	55.1	53.4	51.6	49.9
16	50.0	48.4	46.9	45.4	43.8
17	44.3	42.9	41.6	40.2	38.8
18	39.5	38.3	37.1	35.8	34.7
19	35.4	34.3	33.3	32.2	31.1
20	32.0	31.0	30.0	29.0	28.0
21	29.0	28.1	27.2	26.3	25.4
22	26.4	25.6	24.8	24.0	23.2
23	24.2	23.4	22.7	21.9	21.2
24	22.2	21.5	20.8	20.2	19.5
25	20.5	19.8	19.2	18.6	18.0
26	18.9	18.3	17.7	17.1	16.6
27	17.5	17.0	16.5	15.9	15.4
28	16.3	15.8	15.3	14.8	14.3
29	15.2	14.7	14.3	13.8	13.3
30	14.2	13.8	13.3	12.9	12.5

For load of 200 lbs. per square foot, divide the spacing given by 2.
Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	15 Inch Beam, Light Section.				
	80 lbs.	75 lbs.	70 lbs.	65 lbs.	60 lbs.
10	102.3	98.4	94.5	90.5	86.6
11	84.5	81.3	78.1	74.8	71.6
12	71.0	68.3	65.6	62.9	60.1
13	60.3	58.2	55.9	53.6	51.2
14	52.2	50.2	48.2	46.2	44.2
15	45.5	43.7	42.0	40.3	38.5
16	40.0	38.4	36.9	35.4	33.8
17	35.3	34.0	32.7	31.3	30.0
18	31.6	30.4	29.2	27.9	26.7
19	28.3	27.3	26.2	25.1	24.0
20	25.6	24.6	23.6	22.6	21.6
21	23.2	22.3	21.4	20.5	19.6
22	21.1	20.3	19.5	18.7	17.9
23	19.3	18.6	17.8	17.1	16.4
24	17.8	17.1	16.4	15.7	15.0
25	16.4	15.7	15.1	14.5	13.9
26	15.1	14.5	14.0	13.4	12.8
27	14.0	13.5	12.9	12.4	11.9
28	13.0	12.5	12.0	11.5	11.0
29	12.2	11.7	11.3	10.8	10.3
30	11.4	10.9	10.5	10.1	9.6

For load of 200 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	15 Inch Beam, Standard.				
	60 lbs.	55 lbs.	50 lbs.	45 lbs.	42 lbs.
10	76.9	73.0	69.1	65.2	62.8
11	68.6	60.3	57.1	53.9	51.9
12	53.4	50.7	48.0	45.3	43.6
13	45.5	43.2	40.9	38.6	37.2
14	39.3	37.3	35.3	33.3	32.1
15	34.2	32.4	30.7	29.0	27.9
16	30.0	28.5	27.0	25.5	24.5
17	26.6	25.3	23.9	22.5	21.7
18	23.7	22.5	21.3	20.1	19.4
19	21.3	20.2	19.1	18.1	17.4
20	19.3	18.3	17.3	16.3	15.7
21	17.5	16.6	15.7	14.8	14.2
22	15.9	15.1	14.3	13.5	13.0
23	14.6	13.8	13.1	12.3	11.9
24	13.4	12.7	12.0	11.3	10.9
25	12.4	11.7	11.1	10.4	10.0
26	11.4	10.8	10.2	9.7	9.3
27	10.5	10.0	9.5	8.9	8.6
28	9.8	9.3	8.8	8.3	8.0
29	9.1	8.7	8.2	7.7	7.5
30	8.5	8.1	7.7	7.2	7.0

For load of 200 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	15 Inch Beam, Light Section.				
	80 lbs.	75 lbs.	70 lbs.	65 lbs.	60 lbs.
10	102.3	98.4	94.5	90.5	86.6
11	84.5	81.3	78.1	74.8	71.6
12	71.0	68.3	65.6	62.9	60.1
13	60.3	58.2	55.9	53.6	51.2
14	52.2	50.2	48.2	46.2	44.2
15	45.5	43.7	42.0	40.3	38.5
16	40.0	38.4	36.9	35.4	33.8
17	35.3	34.0	32.7	31.3	30.0
18	31.6	30.4	29.2	27.9	26.7
19	28.3	27.3	26.2	25.1	24.0
20	25.6	24.6	23.6	22.6	21.6
21	23.2	22.3	21.4	20.5	19.6
22	21.1	20.3	19.5	18.7	17.9
23	19.3	18.6	17.8	17.1	16.4
24	17.8	17.1	16.4	15.7	15.0
25	16.4	15.7	15.1	14.5	13.9
26	15.1	14.5	14.0	13.4	12.8
27	14.0	13.5	12.9	12.4	11.9
28	13.0	12.5	12.0	11.5	11.0
29	12.2	11.7	11.3	10.8	10.3
30	11.4	10.9	10.5	10.1	9.6

For load of 200 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	15 Inch Beam, Standard.				
	60 lbs.	55 lbs.	50 lbs.	45 lbs.	42 lbs.
10	76.9	73.0	69.1	65.2	62.8
11	68.6	60.3	57.1	53.9	51.9
12	53.4	50.7	48.0	45.3	43.6
13	45.5	43.2	40.9	38.6	37.2
14	39.3	37.3	35.3	33.3	32.1
15	34.2	32.4	30.7	29.0	27.9
16	30.0	28.5	27.0	25.5	24.5
17	26.6	25.3	23.9	22.5	21.7
18	23.7	22.5	21.3	20.1	19.4
19	21.3	20.2	19.1	18.1	17.4
20	19.3	18.3	17.3	16.3	15.7
21	17.5	16.6	15.7	14.8	14.2
22	15.9	15.1	14.3	13.5	13.0
23	14.6	13.8	13.1	12.3	11.9
24	13.4	12.7	12.0	11.3	10.9
25	12.4	11.7	11.1	10.4	10.0
26	11.4	10.8	10.2	9.7	9.3
27	10.5	10.0	9.5	8.9	8.6
28	9.8	9.3	8.8	8.3	8.0
29	9.1	8.7	8.2	7.7	7.5
30	8.5	8.1	7.7	7.2	7.0

For load of 200 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	8 Inch Beam, Standard.				7 Inch Beam, Standard.		
	25¼ lbs.	23¾ lbs.	20¼ lbs.	17¾ lbs.	20 lbs.	17½ lbs.	15 lbs.
5	73.2	69.0	64.8	60.7	51.5	47.8	44.2
6	50.9	47.9	45.0	42.1	35.8	33.2	30.7
7	37.4	35.2	33.1	30.9	26.3	24.4	22.5
8	28.6	27.0	25.3	23.7	20.1	18.7	17.2
9	22.6	21.3	20.0	18.7	15.9	14.8	13.6
10	18.3	17.3	16.2	15.2	12.9	12.0	11.0
11	15.1	14.3	13.4	12.5	10.6	9.9	9.1
12	12.7	12.0	11.3	10.5	8.9	8.3	7.7
13	10.8	10.2	9.6	9.0	7.6	7.1	6.5
14	9.3	8.8	8.3	7.7	6.6	6.1	5.6
15	8.1	7.7	7.2	6.7	5.7	5.3	4.9
16	7.1	6.7	6.3	5.9	5.0	4.7	4.3
17	6.3	6.0	5.6	5.2	4.5	4.1	3.8
18	5.6	5.3	5.0	4.7	4.0	3.7	3.4
19	5.1	4.8	4.5	4.2	3.5	3.3	3.1
20	4.6	4.3	4.0	3.8	3.2	3.0	2.8
21	4.2	3.9	3.7	3.4	2.9	2.7	2.5
22	3.8	3.6	3.3	3.1	2.7	2.5	2.3

For load of 200 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	6 Inch Beam, Standard.			5 Inch Beam, Standard.		
	17¼ lbs.	14¾ lbs.	12¼ lbs.	14¾ lbs.	12¼ lbs.	9¾ lbs.
5	37.2	34.1	31.0	25.9	23.2	20.6
6	25.9	23.7	21.5	18.0	16.1	14.3
7	19.0	17.4	15.8	13.2	11.9	10.5
8	14.5	13.3	12.1	10.1	9.1	8.0
9	11.5	10.5	9.5	8.0	7.2	6.4
10	9.3	8.5	7.7	6.5	5.8	5.2
11	7.7	7.1	6.4	5.3	4.8	4.3
12	6.5	5.9	5.4	4.5	4.0	3.6
13	5.4	5.0	4.6	3.8	3.4	3.0
14	4.8	4.4	4.0	3.3	3.0	2.6
15	4.1	3.8	3.4	2.9	2.6	2.3
16	3.6	3.3	3.0	2.5	2.3	2.0
17	3.2	2.9	2.7	2.2	2.0	1.8
18	2.9	2.6	2.4	2.0	1.8	1.6
19	2.6	2.4	2.1	1.8	1.6	1.4
20	2.3	2.1	1.9	1.6	1.4	1.3
21	2.1	1.9	1.8	1.5	1.3	1.2
22	1.9	1.8	1.6	1.3	1.2	1.1

For load of 200 lbs. per square foot, divide the spacing given by 2.
Maximum fiber strain, 16,000 lbs. per square inch.

SPACING OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS, FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.

Distance in feet between supports.	4 Inch Beam, Standard.				3 Inch Beam, Standard.		
	10½ lbs.	9½ lbs.	8½ lbs.	7½ lbs.	7¼ lbs.	6½ lbs.	5½ lbs.
5	15.2	14.4	13.6	12.7	8.3	7.7	7.0
6	10.6	10.0	9.4	8.8	5.8	5.3	4.9
7	7.8	7.3	6.9	6.5	4.3	4.0	3.6
8	5.9	5.6	5.3	5.0	3.3	3.0	2.7
9	4.7	4.4	4.2	3.9	2.6	2.4	2.2
10	3.8	3.6	3.4	3.2	2.1	1.9	1.8
11	3.1	3.0	2.8	2.6	1.7	1.6	1.5
12	2.6	2.5	2.3	2.2	1.4	1.3	1.2
13	2.2	2.1	2.0	1.9	1.2	1.1	1.0
14	1.9	1.8	1.7	1.6	1.1	1.0	0.9
15	1.7	1.6	1.5	1.4	0.9	0.9	0.8
16	1.5	1.4	1.3	1.2	.....	.....	.....
17	1.3	1.2	1.2	1.1	.....	.....	.....
18	1.2	1.1	1.0	1.0	.....	.....	.....
19	1.1	1.0	0.9	0.8	.....	.....	.....

For load of 200 lbs. per square foot, divide the spacing given by 2. Maximum fiber strain, 16,000 lbs. per square inch.

GIRDERS IN BUILDINGS.

In the design of a building cases may occur where a single Beam Girder will not answer. It may be found desirable to increase the lengths of the spans so as to reduce the number of supporting columns to a minimum, or, it often occurs, that heavy concentrated loads, such as vaults, brick walls, etc., will render single beam girders inadequate. Various forms of girders may be used in such cases. Where the ends of the girders rest upon the wall, bearing plates should be used to distribute the pressure over a greater surface, and thereby prevent the crushing of the material in the wall directly under the girder.

The allowed pressure per square foot for brick work should not exceed six tons, and for stone twelve to twenty tons, according to its character.

For spaning openings in brick walls, girders composed of two or more I-beams connected by bolts and separators are most commonly used.

The probable line of rupture where the bricks have been laid regularly, if the girders should fail, will be found to be inside the sides of an isosceles triangle, whose base is the span, and whose height is one third of the span. In order to be entirely on the safe side, the weight of wall between vertical lines directly over the girder for a height equal to that of the triangle is frequently adopted as the load to be carried. It should be noted, however, that for green walls, or walls having openings, this rule does not apply.

Placing the weight of brick work at 112 lbs. per cubic foot, the weights for superficial foot for different walls are as follows:

For	9"	wall - - -	84 lbs.
"	13"	" - - - -	121 "
"	18"	" - - - -	168 "
"	22"	" - - - -	205 "
"	26"	" - - - -	243 "

EXPLANATION OF TABLES.

JONES & LAUGHLINS, LIMITED, SECTIONS.

These tables have been in most cases calculated for the lightest weights to which each section can be rolled. Heavier weights can be rolled in the same grooves by separating the rolls, but they are not kept in stock, and can only be obtained by special rolling.

The tables on pages 77 to 87, for Beams, give the loads which a Beam will carry safely (distributed uniformly over its length) for the distances between supports indicated. These loads include the weight of the Beam, which must be deducted in order to arrive at the net load which the Beam will carry. On pages 88 to 124 will also be found the safe loads for other sections and girders.

The values given are based on a maximum fibre strain of 16,000 lbs. per square inch for Beams and Channels, while for other shapes, 12,000 lbs. has been used.

It has been assumed in these tables that proper provision is made for preventing the compression flanges of the Beams from deflecting sideways. They should be held in position at distances not exceeding twenty times the width of the flange, otherwise the strain allowed should be reduced as per table, page 175.

In some instances deflection, rather than absolute strength, may become the governing consideration in determining the size of beam to be used. For Beams carrying plastered ceilings, for example, it has been found by practical tests that, if the deflection exceeds $\frac{1}{360}$ of the distance between supports, or $\frac{1}{12}$ of an inch per foot of the distance, there is danger of the ceiling cracking. This limit is indicated in the following tables by cross lines, beyond which the Beams should not be used, if intended to carry plastered ceilings, unless the allowable loads given in the tables are reduced. There is an element of safety not taken into account in the tables, viz., the fact that the dead load of the floor is carried by the Beams before the plaster is

applied ; consequently, only the deflection due to the live load is liable to cause damage to the plaster. The following method can be used to obtain the reduced loads :

Multiply the load given immediately above the cross line by the square of the corresponding span, and divide by the square of the required span; the result will be the required load. *See example III on page 175.*

A table of deflection of Jones & Laughlins, Limited, sections is given on page 76. It may generally be assumed, both for rolled and built Beams, that the above limit is not exceeded so long as the depth of the Beam is not less than $\frac{1}{20}$ of the distance between supports ($\frac{5}{8}$ inch per foot).

Inasmuch as the carrying capacity of Beams increases largely with their depth, and it is therefore economical to use the greatest depth of Beam consistent with the other conditions to which it is necessary to conform (as clear height, etc.), the above cases of extreme deflection will rarely be met with in practice.

As the deflection of Beams is not very uniform either in Iron or Steel, the question of the relative deflection of Iron and Steel Beams can be decided only from the average results of a large number of tests. Such experiments as have been made, though insufficient in number to be conclusive, indicate that a Steel Beam will deflect slightly less than an Iron Beam of the same section, under the same load, in about the inverse ratio of the moduli of elasticity for these materials as generally assumed, or say as 14 to 15.

The tables on pages 127 to 170, inclusive, for Beams, give the proper spacing, center to center of Beams, for loads varying from 100 to 175 lbs., per square foot, and for spans ranging in length from 5 to 30 feet. The spacing of Beams is inversely proportionate to the loads; therefore, for a load not given in the table, as, for instance, 200 lbs. per square foot, divide the space given for 100 lbs. per square foot by 2, etc.

EXAMPLES OF APPLICATION OF TABLES.

I. What will be the most economical arrangement of floor Beams and Girders for carying a load of 150 lbs., including weight of floor, assuming the floor to be supported by brick arches resting between the Beams and carrying a plastered ceiling below?

ANSWER: The spacing of floor Beams for brick arches, as stated above, should not exceed 6 feet. Referring to page 145, we find the deepest Beam corresponding to this space (above horizontal cross lines) to be a 9" Beam, 21 lbs., with a length of span of 15 feet. The girders to which the floor Beams are framed should, therefore, be spaced 15 feet apart, and from the table we find that a 15" Beam, 50 lbs., 18 feet long, will answer. The relative cost must be determined by the circumstances of the case, *i. e.*, length of columns, etc. The headroom required may render it necessary to use a double girder of shallower beams, say two 10" Beams, 25 lbs., 15 feet long.

II. What size and weight of Beam 19' 6" long in clear between walls, and therefore 20 feet long between centers of supports, will be required to carry safely a uniformly distributed load of 16 tons, the weight of the Beam included?

ANSWER: From the table for safe loads of Beams, a 15" Beam, 42 lbs., will carry safely, for a span of 20 feet, 15.71 tons, or .29 tons less than required in this case. Therefore, a beam of this size and weight will be sufficient to carry the load. Otherwise use Beam weighing 45 lbs., which will carry 16.29 tons.

III. What load uniformly distributed, including its own weight, will a 15″ Beam, weighing 50 lbs. per foot, carry for a span of 30 feet, without deflecting sufficiently to endanger a plastered ceiling?

ANSWER: From the table for safe loads of Beams we find, at the limit indicated for plastered ceilings, that a 15″, 50 lb. Beam will carry safely a uniform load of 13.82 tons over a span of 25 feet. In order not to give rise to undue deflection, the safe load for a 30 foot span, according to the rule given on page 173, will be

$$\frac{13.82 \times 25^2}{30^2} = 9.60 \text{ tons.}$$

BEAMS WITHOUT LATERAL SUPPORT.

Length of Beam.	Proportion of Tabular Load forming greatest safe load.
20 times flange width	Whole tabular load.
30 " "	9/10 " "
40 " "	8/10 " "
50 " "	7/10 " "
60 " "	6/10 " "
70 " "	5/10 " "

GENERAL FORMULAS ON THE FLEXURE OF BEAMS OF ANY CROSS-SECTION.

Let A = area of section, in square inches.
l = length of span, in inches.
W = load, uniformly distributed, in lbs.
M = bending moment, in inch-pounds.
h = height of cross-section, out to out, in inches.
n = distance of center of gravity of section, from top or from bottom, in inches.
s = strain per square inch in extreme fibers of beam, either top or bottom, in lbs., according as n relates to distance from top or from bottom of section.
D = maximum deflection, in inches.
I = moment of inertia of section, neutral axis through center of gravity.
I′ = moment of inertia of section, neutral axis parallel to above, but not through center of gravity.
d = distance between these neutral axes.
R = moment of resistance.
r = radius of gyration, in inches.
E = modulus of elasticity (for wrought iron, assume 27,000,000, for steel, 29,000,000).

Then: $R = \frac{I}{n}$ $\qquad r = \sqrt{\frac{I}{A}}$

$$M = \frac{sI}{n} = sR$$

$$s = \frac{Mn}{I} = \frac{M}{R}$$

$$W = \frac{8sI}{ln} = \frac{8s}{l}R$$

$$s = \frac{Wln}{8I} = \frac{Wl}{8R}$$

$$I' = I + Ad^2$$

$D = \frac{5\,Wl^3}{384\,EI}$ for beam supported at both ends and uniformly loaded.

$D = \frac{Pl^3}{48\,EI}$ for beam supported at both ends and loaded with a single load P at middle.

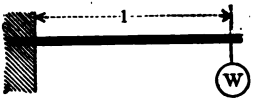
$D = \frac{Wl^3}{8\,EI}$ for beam fixed at one end and unsupported at the other and uniformly loaded.

$D = \frac{Pl^3}{3\,EI}$ for beam fixed at one end and unsupported at other, and loaded with a single load P at the latter end.

BENDING MOMENTS AND DEFLECTIONS OF BEAMS UNDER VARIOUS SYSTEMS OF LOADING.

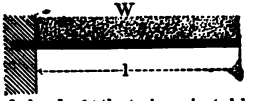
W = total load.
l = length of beam.
I = moment of inertia.
E = modulus of elasticity.

(1) Beam fixed at one end and loaded at the other.



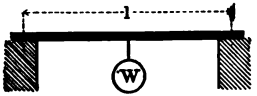
Safe load = ⅛ that given in tables.
Maximum bending moment at point of support = Wl.
Maximum shear at point of support = W.
Deflection = $\frac{Wl^3}{3EI}$

(2) Beam fixed at one end, and uniformly loaded.



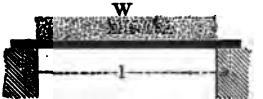
Safe load = ¼ that given in tables.
Maximum bending moment at point of support = $\frac{Wl}{2}$
Maximum shear at point of support = W.
Deflection = $\frac{Wl^3}{8EI}$

(3) Beam supported at both ends, single load in the middle.



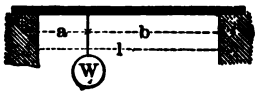
Safe load = ½ that given in tables.
Maximum bending moment at middle of beam = $\frac{Wl}{4}$
Maximum shear at points of support = ½ W.
Deflection = $\frac{Wl^3}{48EI}$

(4) Beam supported at both ends and uniformly loaded.



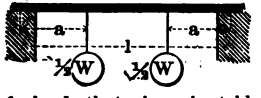
Safe load = that given in tables.
Maximum bending moment at middle of beam = $\frac{Wl}{8}$
Maximum shear at points of support = ½ W.
Deflection = $\frac{Wl^3}{76.8EI}$

(5) Beams supported at both ends, single unsymmetrical load.



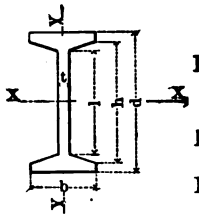
Safe load = that given in tables $\times \frac{l^2}{8ab}$
Max. bending moment under load $= \frac{Wab}{l}$
Maximum shear: at support near $a = \frac{Wb}{l}$; at other support $= \frac{Wa}{l}$
Maximum deflection $= \frac{Wab(2l-a)}{9EIl}\sqrt{\frac{1}{3}a(2l-a)}$

(6) Beam supported at both ends, two symmetrical loads.



Safe load = that given in tables $\times \frac{l}{4a}$
Maximum bending moment between loads = ½ Wa.
Maximum shear between load and nearer support = ½ W.
Max. Deflect. = $\frac{Wa}{48EI}(3l^2-4a^2)$.

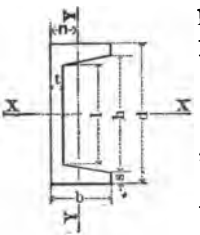
VALUES OF MOMENTS OF INERTIA



$$\text{I, axis X–X} = \frac{b\,d^3 - \frac{1}{4r}(h^4 - l^4)}{12}$$

$$\text{I, axis Y–Y} = \frac{b^3\,(d-h) + l\,t^3 + \frac{r}{4}(b^4 - t^4)}{12}$$

$$\text{Batter} = r = \frac{h-l}{b-t}$$



$$\text{I, axis X–X} = \frac{b\,d^3 - \frac{1}{8r}(h^4 - l^4)}{12}$$

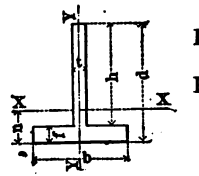
I, axis Y–Y

$$= \frac{2\,s\,b^3 + l\,t^3 + \frac{r}{2}(b^4 - t^4)}{3} - An^2$$

$$n = [b^2\,s + \frac{h\,t^2}{2} + \frac{r}{3}(b-t)^2(b+2t)] \div A$$

$$\text{Area} = A = 2\,b\,s + h\,t + \frac{h-l}{2}(b-t)$$

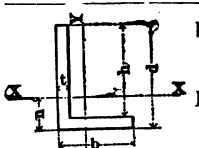
$$\text{Batter} = r = \frac{h-l}{2\,(b-t)}$$



$$\text{I, axis X–X} = \frac{b\,n^3 + t\,(d-n)^3 - (b-t)\,(n-f)^3}{3}$$

$$\text{I, axis Y–Y} = \frac{f\,b^3 + (d-f)\,t^3}{12}$$

$$n = \frac{b\,f^2 + t\,(d^2 - f^2)}{2\,(h\,t + b\,f)}$$

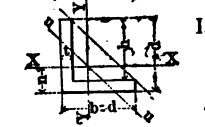


$$\text{I, axis X–X} = \frac{b\,n^3 + t\,(d-n)^3 - (b-t)\,(n-t)^3}{3},$$

for uneven and even angles.

$$\text{I, axis Y–Y} = \frac{d\,n^3 + t\,(b-n)^3 - (d-t)\,(n-t)^3}{3},$$

for uneven angles.



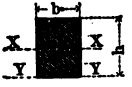
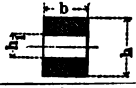
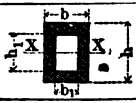
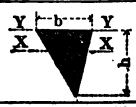
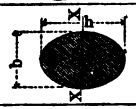
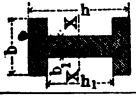
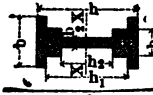
$$\text{I, axis U–U} = \frac{2n^4 - 2\,(n-t)^4 + t[b - (2n - \frac{t}{2})]^3}{3},$$

for even angles.

$$n = \frac{t\,(2h+b) + h^2}{2\,(h+b)},$$ for uneven and even angles.

VALUES OF MOMENTS OF INERTIA—CONTINUED.

I=Moment of Inertia. *R*=Moment of Resistance.

Sections.	I	R
	For axis X–X$=\frac{b\,h^3}{12}$ For axis Y–Y$=\frac{b\,h^3}{3}$	$\frac{b\,h^2}{6}$
	$\frac{b\,(h^3-h_1{}^3)}{12}$	$\frac{b(h^3-h_1{}^3)}{6\,h}$
	$\frac{b\,h^3-b_1h_1{}^3}{12}$	$\frac{bh^3-b_1h_1{}^3}{6\,h}$
	For axis X–X$=\frac{b\,h^3}{36}$ For axis Y–Y$=\frac{b\,h^3}{12}$	Min.$=\frac{bh^2}{24}$
	$\frac{\pi\,d^4}{64}$	$\frac{\pi\,d^3}{32}$
	$\frac{\pi\,(d^4-d_1{}^4)}{64}$	$\frac{\pi(d^4-d_1{}^4)}{32\,d}$
	$\frac{\pi\,b\,h^3}{64}$	$\frac{\pi\,b\,h^2}{32}$
	$\frac{b\,h^3-(b-b_1)\,h_1{}^3}{12}$	$\frac{2\,I}{h}$
	$\frac{b\,h^3-(b-b_1)\,h_1{}^3-(b_1-b_2)\,h_2{}^3}{12}$	$\frac{2\,I}{h}$
	$\frac{b\,h^3-(b-b_1)\,h_1{}^3-(b_1-b_2)\,h_2{}^3-(b_2-b_3)\,h_3{}^3}{12}$	$\frac{2\,I}{h}$

STEEL COLUMNS IN FIRE-PROOF BUILDINGS.

The construction of steel frame fire-proof buildings, though of recent date, is becoming general in large and important cities. In the business centers of our great cities no other form can be used to advantage, and the architects who are keeping pace with improvements recognize the desirability of the improved construction. This change has been facilitated in no small degree by the great improvements made in the art of fire-proof construction, ensuring not only a higher degree of efficiency, but a considerable reduction in cost, as compared with methods formerly practiced.

The old style of solid brick or stone arch, at one time so common, has been almost wholly supplanted by the modern forms of hollow tile and terra cotta, and roofs, ceilings and partition walls are now largely constructed of these refractory materials.

The substitution of steel for iron in beams has hastened this radical improvement. Our patterns of beams and channels, having the highest efficiency, are well adapted for this purpose.

For some time past another change which has gradually taken place has been the substitution of steel for cast iron in the composition of columns, cast iron being a material so uncertain in character that its use in bridge construction has long since been abandoned. In buildings the loads are generally quiescent, and the liability of sudden shocks is more remote than in bridges; yet, on the other hand, the columns seldom receive their loads as favorably as in bridges. In many cases there exists considerable eccentricity, that is, the loads on one side of the column are heavier than on the other side, and the bending strains arising therefrom increase the strains from direct compression materially.

The following are some of the contingencies which may arise in the manufacture of castings, and which preclude anything approaching uniformity in the product:

In the case of hollow cast iron columns, while the metal is yet in a molten state, the buoyancy of the central core tends to cause it to rise, thereby reducing the thickness of the metal above and increasing the same below. When columns are of such lengths as to make it necessary to pour the metal into the moulds from both ends, it sometimes occurs that the iron becomes too much chilled on the surface to properly mix and unite, thus creating a weak seam at the very point where the greatest strength will be needed. The presence of confined air, producing "blow-holes" and "honey-comb," and the collection of impurities at the bottom of the mould, may be further mentioned as frequent sources of weakness in cast iron.

The most critical condition, however, is that due to the unequal contraction of the metal during the process of cooling, thereby giving rise to initial strains, at times of sufficient force to produce rupture in the column or in its lugs on the slightest provocation. In many cases the trouble can be ascribed to faulty designing or carelessness in the execution of the work, yet even under favorable conditions it is so difficult to secure equal radiation from the moulds in all directions, that castings, entirely exempt from inherent shrinkage strains, are probably seldom produced.

As a protection against these contingencies, resort must be had either to the crude or uncertain expedient of a high safety factor, not less than 8 or 10, or a material, such as rolled steel, must be adopted, of a more uniform and reliable character than cast iron.

Steel columns fail either by deflecting bodily out of a straight line, or by buckling of the metal between rivets or other points of support. Both actions may take place at the same time, but if the latter occurs alone, it may be an indication that the rivet spacing or the thickness of the metal is insufficient.

The rule has been deducted from actual experiments upon Steel Columns, that the distance between centers of rivets should not exceed, in the line of strain, sixteen times the

thickness of metal of the parts joined, and that the distance between rivets or other points of support, at right angles to the line of strain, should not exceed thirty-two times the thickness of the metal.

On page 63 are shown sections of some of the most common forms of built columns. Figures 4 and 6 are known as closed columns. As it is impracticable to repaint the inner surface of such columns, it is preferable to use them only for interior work where the changes in temperature are not considerable and the air is dry. In places exposed to the extremes of temperature and unprotected from rain, the paint on the inner surface of the column will sooner or later cease to be a protection. Corrosion will set in and, once begun, will continue as long as there is unoxidized metal left in the column. The remaining figures on this page represent columns with open sections or latticed columns, which admit of repainting and are suitable for out-of-door work.

On pages 17, 18 and 19 are shown sections of the Larimer column, which has recently been placed on the market. Its claims for superiority over any other steel or iron column are based mainly on the following qualities:

1ST. ECONOMY OF AND PROMPTNESS OF MANUFACTURE.

It has only one row of rivets, while two or more rows are required by other columns, and being made of beams, special shapes do not have to be rolled, as the beams can be taken from stock, saving the time necessary for rolling special sections.

2ND. HIGH ULTIMATE RESISTANCE TO COMPRESSION.

Actual tests show that the resistance to compression for the Larimer column is greater than for any other of equal weight and sectional area.

3RD. ADAPTABILITY FOR CONNECTIONS WITH BEAMS, ETC.

When used in buildings for supporting floor beams, either single or double, these qualities are of the greatest importance. Connections can be readily made to the Larimer columns at any point and from any angle. For details of connections, see pages 64 and 65.

4TH. INSPECTION AND PAINTING.

When columns are used for out-door work or in places exposed to dampness and not covered permanently with fireproofing, this column can be more readily inspected and repainted than any other form, there being less hidden surface.

When it is desired to carry unusually heavy loads, as is frequently the case for the lower stories of very high buildings, the Larimer columns can be reinforced to the required strength, either by plates riveted to each flange, or by plates forming a box entirely covering the Larimer column. See page 119.

Cast and steel bases are shown on page 63. Complete tables giving the safe loads in tons for Larimer columns may be found on pages 114 to 119.

STANDARD SPECIFICATIONS

GOVERNING THE

PHYSICAL PROPERTIES OF STRUCTURAL AND SPECIAL OPEN-HEARTH PLATE AND RIVET STEEL

AS ADOPTED BY

THE ASSOCIATION OF AMERICAN STEEL MANUFACTURERS.

STRUCTURAL STEEL.

Process of Manufacture. (1) Steel may be made by either the open-hearth or Bessemer process.

Test Pieces. (2) All tests and inspections shall be made at place of manufacture prior to shipment.

(3) The tensile strength, limit of elasticity and ductility shall be determined from a standard test piece cut from the finished material and planed, milled or turned parallel. The elongation shall be measured on an original length of eight inches, except when the thickness of the finished material is $\frac{5}{8}$ inch or less, in which case the elongation shall be measured in a length equal to sixteen times the thickness; and except in rounds of $\frac{5}{8}$ inch or less in diameter, in which case the elongation shall be measured in a length equal to eight times the diameter of section tested. Two test pieces shall be taken from each melt or blow of finished material, one for tension and one for bending.

(3*a*) Material which is to be used without annealing or further treatment is to be tested in the condition in which it comes from the rolls. When material is to be annealed or otherwise treated before use, the specimen representing such material is to be similarly treated before testing.

(4) Every finished piece of steel shall be stamped with the blow or melt number, and steel for pins shall have the blow or melt number stamped on the ends. Rivet and lacing steel, and small pieces for pin plates and stiffeners, may be shipped in bundles securely wired together, with the blow or melt number on a metal tag attached.

Finish. (5) Finished bars must be free from injurious seams, flaws or cracks, and have a workmanlike finish.

GRADES OF STEEL.

(6) Steel shall be of three grades, Rivet, Soft and Medium.

Rivet Steel. (7) Ultimate strength, 48,000 to 58,000 pounds per square inch. Elastic limit, not less than one-half the ultimate strength. Elongation, 26 per cent. Bending test, 180 degrees flat on itself, without fracture on outside of bent portion.

Soft Steel. (8) Ultimate strength, 52,000 to 62,000 pounds per square inch. Elastic limit not less than one-half the ultimate strength. Elongation 25 per cent. Bending test, 180 degrees flat on itself, without fracture on outside of bent portion.

Medium Steel. (9) Ultimate strength, 60,000 to 70,000 pounds per square inch. Elastic limit not less than one-half the ultimate strength. Elongation, 22 per cent. Bending test, 180 degrees to a diameter equal to thickness of piece tested, without fracture on outside of bent portion.

Pin Steel. (10) Pins made from either of the above mentioned grades of steel shall, on specimen test pieces cut at a depth of one inch from surface of finished material, fill the physical requirements of the grade of steel from which it is rolled, for ultimate strength, elastic limit, and bending, but the required elongation shall be decreased 5 per cent.

Eye-Bar Steel. (11) Eye-bar material, 1½ inches and less in thickness, made of either of the above-mentioned grades of steel, shall, on test pieces cut from finished material, fill the requirements of the grade of steel from which it is rolled. For thickness greater than 1½ inches, there will be allowed a reduction in the percentage of elongation of one per cent. for each ⅛ of an inch increase of thickness, to a minimum of 20 per cent. for medium steel and 22 per cent. for soft steel.

Full Size Test of Steel Eye-Bars. (12) Full size test of steel eye-bars shall be required to show not less than 10 per cent. elongation in the body of the bar, and tensile strength not more than 5,000 pounds below the minimum tensile strength required in specimen tests of the grade of steel from which they are rolled. The bars will be required to break in the body, but should a bar break in the head, but develop 10 per cent. elongation and the ultimate strength specified, it shall not be cause for rejection, provided not more than one-third of the total number of bars tested break in the head; otherwise the entire lot will be rejected.

Variation in Weight. (13) The variation in cross-section or weight of more than 2½ per cent. from that specified will be sufficient cause for rejection, except in the case of sheared plates ordered to gauge, when there will be permitted an excess of weight, over that corresponding to the dimensions on the order, equal in amount to that specified in the following table:

Table of Allowances for Overweight for Rectangular Plates.

Thickness of Plate.	Width of Plate.	
	Up to 75 in.	75 in. to 100 in.
¼ inch.	10 per cent.	14 per cent.
5/16 "	8 "	12 "
⅜ "	7 "	10 "
7/16 "	6 "	8 "
½ "	5 "	7 "
9/16 "	4½ "	6½ "
⅝ "	4 "	6 "
Over ⅝ "	3½ "	5 "

Specifications for Structural Cast Iron. (1) Except where chilled iron is specified, all castings shall be tough gray iron, free from injurious co d-shuts or blow-holes, true to pattern, and of a workmanlike finish. Sample pieces one inch square, cast from the same heat of metal in sand moulds, shall be capable of sustaining, on a clear span of 4 feet 8 inches, a central load of 500 pounds when tested in the rough bar.

SPECIAL OPEN-HEARTH PLATE AND RIVET STEEL.

Test Pieces. (1) All tests and inspections shall be made at place of manufacture prior to shipment.

(2) The tensile strength, limit of elasticity and ductility, shall be determined from a standard test piece cut from the finished material and planed, milled or turned parallel. The elongation shall be measured on an original length of 8 inches, except when the thickness of the finished material is ⅛ inch or less, in which case the elongation shall be measured in a length equal to sixteen times the thickness; and except in rounds of ⅝ inch or less in diameter, in which case the elongation shall be measured in a length equal to eight times the diameter of section tested. Four test pieces shall be taken from each melt of finished material; two for tension and two for bending.

(2a) Material which is to be used without annealing or further treatment is to be tested in the condition in which it comes from the rolls. When material is to be annealed or otherwise treated before use, the specimen representing such material is to be similarly treated before testing.

(3) Every finished piece of steel shall be stamped with the melt number. Rivet steel may be shipped in bundles securely wired together, with the melt number on a metal tag attached.

GRADES OF STEEL.

Extra Soft Steel. (4) Ultimate strength, 45,000 to 55,000 pounds per square inch. Elastic limit, not less than one-half the ultimate strength. Elongation, 28 per cent. Cold and Quench bends, 180 degrees flat on itself without fracture on outside of bent portion.

Fire Box Steel. (5) Ultimate strength, 52,000 to 62,000 pounds per square inch. Elastic limit, not less than one-half the ultimate strength. Elongation, 26 per cent. Cold and Quench bends, 180 degrees flat on itself, without fracture on outside of bent portion.

Flange or Boiler Steel. (6) Ultimate strength, 52,000 to 62,000 pounds per square inch. Elastic limit, not less than one-half the ultimate strength. Elongation, 25 per cent. Cold and Quench bends, 180 degrees flat on itself, without fracture on outside of bent portion.

Boiler Rivet Steel. (7) Steel for the boiler rivets shall be made of the extra soft quality specified in paragraph No. 4.

For all plates ordered to gauge, there will be permitted an excess of weight over that corresponding to the dimensions on the order equal in amount to that specified in the following table:

Table of Allowances for Overweight for Rectangular Plates.

Thickness of Plate.	Width of Plate.	
	Up to 75 in.	75 in. to 100 in.
¼ inch.	10 per cent.	14 per cent.
5/16 "	8 "	12 "
⅜ "	7 "	10 "
7/16 "	6 "	8 "
½ "	5 "	7 "
9/16 "	4½ "	6½ "
⅝ "	4 "	6 "
Over ⅝ "	3½ "	5 "

PROPERTIES OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS.

1	2	3	4	5	6	7	8	9	10	11	12	13
Section.	Depth of Beam.	Weight per Foot.	Area of Section.	Thickness of Web.	Width of Flange.	Moment of Inertia, Neutral Axis perpendicular to Web at center.	Section Factor, Neutral Axis as before.	Radius of Gyration, Neutral Axis as before.	Coefficient of Strength for Fiber Strain of 16000 Lbs. per Sq. In. Used for Buildings.	Coefficient of Strength for Fiber Strain of 12500 Lbs. per Sq. In. Used for Bridges.	Moment of Inertia, Neutral Axis Coincident with Center Line of Web.	Radius of Gyration, Neutral Axis as before.
No.	Inches.	Lbs.	Sq. In.	Inches.	Inches.	I	R	r	C	C′	I′	r′
	24	100	29.2	.745	7.245	2369.6	197.5	9.01	2,106,300	1,645,600	48.35	1.29
	24	80	23.32	.5	7.	2087.2	173.9	9.46	1,855,300	1,449,500	42.86	1.36
B–1	20	100	29.62	.894	7.294	1662.3	166.2	7.49	1,773,200	1,385,300	52.92	1.34
B–1	20	80	23.73	.6	7.	1466.3	146.6	7.86	1,564,200	1,222,000	45.81	1.39
B–2	20	80	23.79	.735	6.485	1326.4	132.6	7.46	1,414,800	1,105,300	31.74	1.15
B–2	20	64	19.08	.5	6.25	1169.5	116.95	7.83	1,247,500	974,800	27.86	1.21
	15	100	29.46	1.192	6.792	899.4	119.92	5.53	1,279,200	999,300	50.92	1.31
	15	80	23.57	.8	6.4	789.1	105.2	5.79	1,122,300	876,800	41.31	1.32
B–3	15	80	23.56	.982	6.392	719.3	95.9	5.53	1,023,000	799,200	32.50	1.18
B–3	15	60	17.67	.59	6.	609.0	81.2	5.87	866,100	676,700	25.96	1.22
B–4	15	60	17.78	.763	5.853	541.0	72.1	5.52	769,400	601,100	18.27	1.01
B–4	15	42	12.48	.41	5.5	441.8	58.9	5.95	628,300	490,800	14.62	1.08

PROPERTIES OF JONES & LAUGHLINS, LIMITED, STEEL BEAMS—CONTINUED.

1	2	3	4	5	6	7	8	9	10	11	12	13
B- 5	12	55.	16.25	.828	5.618	321.89	53.6	4.45	572,300	447,100	17.54	1.04
B- 5	12	40.	11.84	.46	5.25	268.95	44.8	4.77	478,100	373,600	13.81	1.08
B- 6	12	40.	11.76	.558	5.208	245.81	41.0	4.57	437,000	341,400	10.95	.97
B- 6	12	31.5	9.3	.35	5.	215.81	36.0	4.82	383,700	299,800	9.5	1.01
B- 7	10	40.	11.69	.75	5.1	158.85	31.8	3.68	338,900	264,800	9.51	.9
B- 7	10	25.	7.35	.31	4.66	122.1	24.4	4.07	260,500	203,500	6.89	.97
B- 8	9	35.	10.29	.747	4.787	112.68	25.0	3.31	267,000	208,600	7.4	.84
B- 8	9	21.	6.31	.29	4.33	84.92	18.9	3.7	201,300	157,200	5.16	.9
B- 9	8	25.25	7.43	.546	4.276	68.64	17.2	3.04	183,100	143,000	4.76	.8
B- 9	8	17.75	5.22	.27	4.	56.87	14.2	3.31	151,700	118,500	3.78	.84
B-10	7	20.	5.88	.46	3.87	42.23	12.1	2.68	128,700	100,600	3.24	.74
B-10	7	15.	4.42	.25	3.66	36.23	10.4	2.87	110,400	86,200	2.67	.78
B-11	6	17.25	5.07	.475	3.575	26.2	8.7	2.27	93,100	72,800	2.36	.68
B-11	6	12.25	3.61	.23	3.33	21.79	7.3	2.46	77,400	60,500	1.85	.72
B-12	5	14.75	4.34	.504	3.294	15.15	6.1	1.87	64,700	50,500	1.71	.63
B-12	5	9.75	2.87	.21	3.	12.09	4.8	2.05	51,600	40,300	1.23	.65
B-13	4	10.5	3.09	.41	2.88	7.14	3.6	1.52	38,100	29,800	1.01	.57
B-13	4	7.5	2.21	.19	2.66	5.97	3.0	1.65	31,800	24,900	.77	.59
B-14	3	7.5	2.21	.366	2.526	2.92	1.9	1.15	20,800	16,200	.61	.52
B-14	3	5.5	1.63	.17	2.33	2.48	1.7	1.23	17,600	13,800	.46	.53

L—Safe Load in lbs. uniformly distributed. l—span in feet
M—Moment of Forces in foot-lbs C and C′—Coefficient given above $\left\{ L=\frac{C \text{ or } C'}{l};\ M=\frac{C \text{ or } C'}{8};\right.$ C or C′—Ll—8 M

PROPERTIES OF JONES & LAUGHLINS, LIMITED, STEEL CHANNELS.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Section.	Depth of Channel.	Weight per Foot.	Area of Section.	Thickness of Web.	Width of Flange.	Moment of Inertia, Neutral Axis perpendicular to Web at center.	Section Factor, Neutral Axis as before.	Radius of Gyration, Neutral Axis as before.	Coefficient of Strength for Fiber Strain of 16000 Lbs. per Sq. In. Used for Buildings.	Coefficient of Strength for Fiber Strain of 12500 Lbs. per Sq. In. Used for Bridges.	Moment of Inertia, Neutral Axis Coincident with Center Line of Web.	Radius of Gyration, Neutral Axis as before.	Distance of Center of Gravity from Outside of Web.
No.	In.	Lbs.	Sq. In.	Inches.	Inches.	I	R	r	C	C′	I′	r′	Inches.
C–1	15	55.	16.37	.831	3.831	433.88	57.85	5.15	617,100	482,100	12.32	.87	.83
C–1	15	33.	9.9	.4	3.4	312.56	41.67	5.62	444,500	347,200	8.28	.91	.79
C–2	12	40.	11.76	.758	3.418	196.93	32.82	4.09	350,100	273,500	6.63	.75	.72
C–2	12	20.5	6.03	.28	2.94	128.11	21.35	4.61	227,800	177,900	3.91	.81	.70
C–3	10	35.	10.34	.828	3.188	115.90	23.18	3.35	247,300	193,200	4.68	.67	.70
C–3	10	15.	4.46	.24	2.6	66.88	13.38	3.87	142,700	111,500	2.30	.72	.64
C–4	9	25.	7.35	.614	2.814	70.65	15.70	3 10	167,500	130,800	2.98	.64	.62
C–4	9	13.25	3.89	.23	2.43	47.32	10.52	3.49	112,200	87,600	1.77	.67	.61
C–5	8	21.25	6.3	.588	2.628	47.99	12.00	2.76	128,000	100,000	2.27	.60	.59
C–5	8	11.25	3.35	.22	2.26	32.30	8.08	3.11	86,100	67,300	1.33	.63	.58

L—Safe Load in lbs., uniformly distributed. l—Span in feet.
M—Moment of forces in foot-lbs. C and C′—Coefficients given above $\left\{ L=\frac{C \text{ or } C'}{l};\ M=\frac{C \text{ or } C'}{8};\ C \text{ or } C'=Ll=8M. \right.$

PROPERTIES OF JONES & LAUGHLINS, LIMITED, STEEL CHANNELS—CONTINUED.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Section.	Depth of Channel.	Weight per Foot.	Area of Section.	Thickness of Web.	Width of Flange.	Moment of Inertia, Neutral Axis perpendicular to Web at center.	Section Factor, Neutral Axis as before.	Radius of Gyration, Neutral Axis as before.	Coefficient of Strength for Fiber Strain of 16000 Lbs. per Sq. In. Used for Buildings.	Coefficient of Strength for Fiber Strain of 12000 Lbs. per Sq. In. Used for Bridges.	Moment of Inertia, Neutral Axis Coincident with Center Line of Web.	Radius of Gyration, Neutral Axis as before.	Distance of Center of Gravity from Outside of Web.
No.	In.	Lbs.	Sq. In.	Inches.	Inches.	I	R	r	C	C′	I′	r′	Inches.
C– 6	7	19.75	5.79	.63	2.51	33.10	9.46	2.39	100,900	78,800	1.85	.56	.58
C– 6	7	9.75	2.85	.21	2.09	21.09	6.03	2.72	64,300	50,200	.98	.59	.55
C– 7	6	15.5	4.59	.568	2.288	19.61	6.54	2.07	69,700	54,500	1.29	.53	.55
C– 7	6	8.	2.38	.2	1.92	13.00	4.33	2.34	46,200	36,100	.70	.54	.52
C– 8	5	11.5	3.42	.484	2.044	10.48	4.19	1.75	44,700	34,900	.83	.49	.51
C– 8	5	6.5	1.95	.19	1.75	7.42	2.97	1.95	31,600	24,700	.48	.50	.49
C– 9	4	7.25	2.14	.327	1.727	4.58	2.29	1.46	24,400	19,100	.44	.46	.46
C– 9	4	5.25	1.55	.18	1.58	3.79	1.90	1.56	20,200	15,800	.32	.45	.46
C–10	3	6.	1.78	.366	1.606	2.08	1.38	1.08	14,800	11,500	.32	.42	.46
C–10	3	4.	1.19	.17	1.41	1.64	1.09	1.17	11,600	9,100	.20	.41	.44

L=Safe Load in lbs., uniformly distributed. l=Span in feet.
M=Moment of forces in foot-lbs. C and C′=Coefficients given above $\left\{ L=\frac{C \text{ or } C'}{l};\ M=\frac{C \text{ or } C'}{8};\ C \text{ or } C'=Ll=8\,M. \right.$

TEES.

PROPERTIES OF JONES & LAUGHLINS, LIMITED, TEES.

1	2	3	4	5	6	7	8	9	10	11	12	13
Section.	Size Flange by Stem.	Weight per Foot.	Area of Section.	Dist. of Center of Gravity from outside of Flange.	Moment of Inertia, Neutral Axis thro' Center of Gravity, parallel to Flange.	Section Factor, Neutral Axis as before.	Radius of Gyration, Neutral Axis as before.	Moment of Inertia, Neutral Axis thro' center of Gravity, coincident with Stem.	Moment of Resistance, Neutral Axis as before.	Radius of Gyration, Neutral Axis as before.	Coefficient of strength for fiber strain of 12,000 lbs. per square inch, Neutral Axis through center of Gravity, parallel to Flange.	Coefficient of strength for fiber strain of 10,000 lbs. per square inch, Neutral Axis as before.
No.	Inches.	Pounds.	Sq. Inch.	Inches.	I	R	r	I'	R'	r'	C	C'
T 20	4 ×5	16.00	4.70	1.55	11.55	3.25	1.54	3.06	1.53	0.79	26800	22340
T 21	4 ×4¼	15.50	4.56	1.48	9.99	3.05	1.46	3.27	1.63	0.88	24440	20380
T 22	4 ×4¼	15.00	4.41	1.39	8.57	2.76	1.38	3.06	1.53	0.82	22050	18380
T 1	4 ×4	14.00	4.12	1.20	6.12	2.19	1.21	3.05	1.52	0.85	17490	14580
T 2	4 ×4	12.00	3.53	1.19	5.42	1.93	1.22	2.61	1.31	0.85	15420	12850
T 3	3½×3½	10.40	3.06	1.00	3.46	1.38	1.04	1.70	0.97	0.73	11060	9220
T 4	3½×3½	9.30	2.73	0.91	3.09	1.20	1.01	1.47	0.84	0.70	9570	7980
T 23	3½×3	9.88	2.94	0.83	2.22	1.02	0.87	1.70	0.97	0.76	8170	6810

1	2	3	4	5	6	7	8	9	10	11	12	13
T 24	3½×3	9.00	2.65	0.75	1.99	0.88	0.84	1.47	0.84	0.72	7070	5900
T 26	3 ×3½	9.00	2.65	1.06	3.29	1.35	1.05	1.08	0.71	0.60	10770	8980
T 25	3 ×3½	8.50	2.50	0.98	2.94	1.17	1.03	0.93	0.62	0.58	9330	7780
T 5	3 ×3	7.85	2.30	0.89	1.88	0.89	0.91	0.93	0.62	0.64	7160	5970
T 6	3 ×3	6.60	1.94	0.87	1.63	0.77	0.92	0.78	0.52	0.63	6150	5130
T 7	2½×2½	6.32	1.86	0.79	1.04	0.61	0.75	0.54	0.43	0.54	4870	4060
T 8	2½×2½	5.40	1.59	0.74	0.92	0.52	0.75	0.45	0.36	0.53	4170	3480
T 28	2½×2	4.80	1.41	0.54	0.46	0.32	0.57	0.43	0.34	0.55	2540	2120
T 9	2½×2½	4.62	1.36	0.68	0.63	0.40	0.67	0.32	0.28	0.48	3200	2670
T 10	2½×2½	4.12	1.21	0.67	0.49	0.33	0.67	0.25	0.23	0.48	2610	2170
T 11	2 ×2	3.50	1.03	0.56	0.37	0.25	0.59	0.18	0.18	0.41	2040	1700
T 27	2½×1½	3.90	1.15	0.44	0.25	0.19	0.48	0.37	0.29	0.58	1540	1290
T 13	1½×1½	3.00	0.88	0.51	0.24	0.19	0.51	0.12	0.14	0.36	1530	1280
T 12	1½×1½	2.33	0.69	0.50	0.16	0.13	0.48	0.092	0.10	0.36	1020	850
T 14	1½×1½	2.62	0.77	0.46	0.14	0.14	0.44	0.076	0.10	0.32	1100	920
T 15	1½×1½	1.90	0.56	0.47	0.12	0.11	0.47	0.058	0.077	0.33	910	760
T 16	1½×1½	1.95	0.57	0.42	0.080	0.097	0.37	0.045	0.072	0.28	780	650
T 17	1½×1½	1.55	0.45	0.40	0.062	0.073	0.37	0.034	0.054	0.27	580	490
T 18	1 ×1	1.25	0.36	0.33	0.032	0.047	0.29	0.017	0.035	0.22	380	310
T 19	1 ×1	0.90	0.26	0.30	0.024	0.034	0.30	0.012	0 024	0.21	270	230

ANGLES.

PROPERTIES OF JONES & LAUGHLINS, LIMITED, ANGLES.

ANGLES WITH UNEQUAL LEGS.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Section.	Size.	Thickness.	Weight per Foot.	Area of Section.	Perpendicular distances from centre of gravity to back of flanges.		Moments of Inertia. I		Section Factor. R		Radius of Gyration. r		
					To back of longer flange.	To back of shorter flange.	Neutral Axis parallel to longer flange.	Neutral Axis parallel to shorter flange.	Neutral Axis parallel to longer flange.	Neutral Axis parallel to shorter flange.	Neutral Axis parallel to longer flange.	Neutral Axis parallel to shorter flange.	Least radius, axis diagonal.
No.	Inches.	Inches	Pounds.	Sq. Inch.	Inches.	Inches.	I	I′	R	R′	r	r′	r²
A 12	6 × 4	⅜	12.30	3.61	0.94	1.94	4.90	13.47	1.60	3.32	1.14	1.90	0.92
"	"	15/16	25.40	7.47	1.10	2.10	9.14	25.95	3.15	6.65	1.08	1.88	0.91
A 13	6 × 3½	⅜	11.60	3.42	0.79	2.04	3.34	12.86	1.23	3.25	0.98	1.93	0.84
"	"	15/16	24.00	7.06	0.95	2.20	6.15	24.69	2.41	6.20	0.93	1.86	0.83
A 25	5 × 4	⅜	11.00	3.23	1.03	1.53	4.67	8.14	1.57	2.35	1.20	1.59	0.87
"	"	¾	21.00	6.17	1.17	1.67	8.09	14.35	2.86	4.31	1.11	1.48	0.86
A 14	5 × 3½	⅜	10.40	3.05	0.86	1.61	3.18	7.78	1.20	2.29	1.02	1.60	0.80
"	"	¾	19.80	5.81	1.00	1.75	5.45	13.70	2.18	4.22	0.98	1.48	0.79
A 15	5 × 3	⅜	9.70	2.86	0.70	1.70	2.04	7.37	0.89	2.28	0.85	1.61	0.70
"	"	½	18.50	5.44	0.84	1.84	3.47	13.04	1.61	4.13	0.77	1.50	0.69

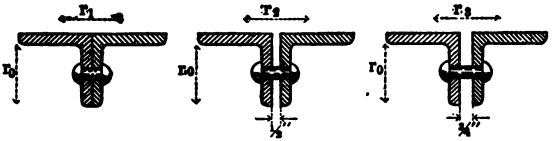
1	2	3	4	5	6	7	8	9	10	11	12	13	14
A 26	4 × 3½	⅜	9.10	2.68	0.96	1.21	2.99	4.18	1.18	1.50	1.06	1.25	0.74
"	"	½	17.20	5.06	1.09	1.34	5.13	7.26	2.13	2.78	0.97	1.15	0.73
A 16	4 × 3	⅜	8.50	2.48	0.78	1.28	1.88	3.88	0.85	1.43	0.87	1.25	0.67
"	"	½	15.90	4.69	0.92	1.42	3.24	6.85	1.56	2.66	0.80	1.16	0.65
A 27	3½ × 2½	⅜	7.70	2.26	0.68	1.24	1.28	3.16	0.66	1.26	0.75	1.19	0.60
"	"	½	14.30	4.35	0.81	1.37	2.15	5.47	1.18	2.29	0.69	1.10	0.59
A 17	3½ × 3	⅜	7.80	2.30	0.83	1.08	1.80	2.66	0.83	1.09	0.88	1.08	0.64
"	"	½	15.80	4.65	0.96	1.21	3.11	4.65	1.52	2.03	0.81	0.99	0.64
A 18	3½ × 2½	¼	4.90	1.44	0.61	1.11	0.78	1.80	0.41	0.75	0.74	1.12	0.56
"	"	½	9.40	2.75	0.86	1.36	1.32	3.13	0.81	1.46	0.67	1.03	0.56
A 19	3 × 2½	¼	4.50	1.31	0.66	0.91	0.74	1.17	0.40	0.56	0.73	0.92	0.54
"	"	½	8.50	2.50	0.75	1.00	1.28	2.06	0.73	1.03	0.68	0.86	0.54
A 28	3½ × 2	3/16	3.30	0.97	0.46	1.09	0.33	1.10	0.21	0.51	0.59	1.07	0.47
"	"	½	8.10	2.38	0.57	1.20	0.68	2.38	0.48	1.16	0.52	0.97	9.46
A 29	3 × 2	3/16	3.10	0.91	0.47	1.97	0.31	0.86	0.20	0.84	0.58	0.97	0.46
"	"	½	7.70	2.26	0.58	1.08	0.67	1.92	0.47	1.00	0.54	0.91	0.46
A 20	2½ × 2	3/16	2.80	0.81	0.51	0.76	0.29	0.51	0.19	0.29	0.60	0.79	0.43
"	"	½	6.80	2.00	0.63	0.88	0.64	1.14	0.47	0.71	0.58	0.77	0.43
A 50	1⅛ × ⅞	⅛	0.85	0.25	0.22	0.47	0.016	0.052	0.024	0.057	0.25	0.46	0.21
A 51	1 × ⅝	⅛	0.63	0.19	0.13	0.32	0.0058	0.019	0.012	0.028	0.17	0.32	0.15

ANGLES.

PROPERTIES OF JONES & LAUGHLINS, LIMITED, ANGLES WITH EQUAL LEGS.

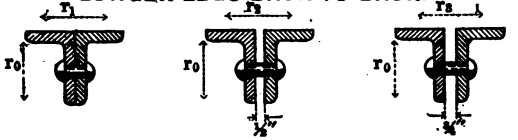
Section.	Size.	Thickness.	Weight per foot.	Area of Section.	Distance of center of grav. to back of flange.	Moment of inertia neutral axis through center of grav. parallel to flange.	Section factor neutral axis as before.	Radius of gyration neutral axis as before.	Least radius of gyration neutral axis through center of gravity at angle of 45°.
No.	Inches.	In.	Lbs.	Sq. in.	In.	I	R	r	r'
A 1	6 ×6	1	17.2	5.06	1.66	17.68	4.07	1.88	1.25
		7/8	33.1	9.74	1.82	31.92	7.64	1.78	1.17
A 21	5 ×5	3/4	11.3	3.32	1.37	8.13	2.22	1.55	1.03
		5/8	23.1	6.79	1.25	15.74	4.52	1.39	0.93
A 2	4 ×4	1/2	9.7	2.86	1.14	4.36	1.52	1.24	0.83
		5/8	18.5	5.44	1.27	7.66	2.81	1.14	0.76
A 3	3½×3½	1/2	8.5	2.48	1.01	2.87	1.15	1.07	0.72
		5/8	17.0	5.00	1.15	4.77	2.03	0.96	0.64
A 22	3¼×3¼	1/2	7.8	2.29	0.95	2.27	0.99	0.99	0.66
		5/8	14.7	4.32	1.08	2.96	1.36	0.79	0.53
A 4	3 ×3	1/4	4.83	1.45	0.84	1.24	0.58	0.92	0.61
		1/2	12.20	3.66	0.98	2.62	1.30	0.84	0.56
A 23	2⅝×2⅝	1/4	4.5	1.32	0.78	0.93	0.48	0.84	0.56
		1/2	8.5	2.50	0.87	1.67	0.89	0.80	0.53
A 5	2½×2½	1/4	4.0	1.19	0.72	0.70	0.40	0.76	0.51
		1/2	7.7	2.25	0.81	1.23	0.73	0.72	0.48
A 24	2¼×2¼	1/4	3.6	1.06	0.66	0.51	0.32	0.69	0.46
		1/2	6.8	2.00	0.74	0.87	0.58	0.64	0.43
A 6	2 ×2	1/4	1.7	0.48	0.55	0.22	0.15	0.67	0.45
		7/16	5.3	1.56	0.66	0.54	0.40	0.57	0.38
A 7	1¾×1¾	1/4	1.4	0.42	0.49	0.14	0.11	0.57	0.38
		7/16	4.6	1.30	0.59	0.35	0.30	0.48	0.32
A 8	1½×1½	1/4	1.2	0.36	0.42	0.083	0.077	0.48	0.32
		3/8	3.3	0.99	0.51	0.191	0.191	0.42	0.28
A 9	1¼×1¼	1/4	1.0	0.30	0.35	0.044	0.049	0.38	0.25
		3/8	1.9	0.56	0.40	0.077	0.090	0.36	0.24
A 10	1 ×1	1/4	0.8	0.24	0.30	0.022	0.031	0.30	0.20
		7/16	1.2	0.34	0.32	0.029	0.042	0.28	0.19
A 11	⅝× ⅝	1/4	0.6	0.17	0.23	0.009	0.017	0.22	0.15
		7/16	0.8	0.25	0.26	0.012	0.024	0.21	0.14

RADII OF GYRATION FOR TWO EQUAL LEGGED ANGLES, PLACED BACK TO BACK.



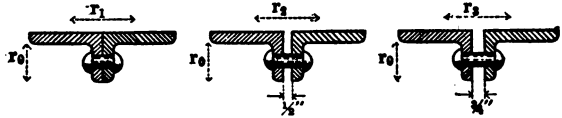
Size, Inches.	Thickness, Inches.	Weight per foot of Single Angle. Lbs.	RADII OF GYRATION.			
			r_0	r_1	r_2	r_3
6 ×6	$\frac{7}{16}$	17.20	1.88	2.51	2.68	2.77
	$\frac{1}{2}$	33.10	1.78	2.55	2.73	2.83
5 ×5	$\frac{11}{16}$	11.25	1.55	2.07	2.24	2.33
	$\frac{1}{2}$	23.60	1.39	2.13	2.31	2.41
4 ×4	$\frac{3}{8}$	9.70	1.24	1.68	1.86	1.95
	$\frac{1}{2}$	18.50	1.14	1.71	1.90	2.00
$3\frac{1}{2}\times3\frac{1}{2}$	$\frac{3}{8}$	8.50	1.07	1.47	1.66	1.75
	$\frac{1}{2}$	17.00	0.96	1.50	1.69	1.80
$3\frac{1}{2}\times3\frac{1}{2}$	$\frac{3}{8}$	7.80	0.99	1.37	1.56	1.65
	$\frac{1}{2}$	14.70	0.79	1.41	1.61	1.71
3 ×3	$\frac{1}{4}$	4.90	0.92	1.25	1.43	1.53
	$\frac{3}{8}$	11.40	0.84	1.29	1.48	1.59
$2\frac{1}{2}\times2\frac{1}{2}$	$\frac{1}{4}$	4.50	0.84	1.15	1.34	1.44
	$\frac{1}{2}$	8.50	0.80	1.18	1.38	1.48
$2\frac{1}{2}\times2\frac{1}{2}$	$\frac{1}{4}$	4.00	0.76	1.05	1.24	1.34
	$\frac{1}{2}$	7.70	0.72	1.08	1.27	1.38
$2\frac{1}{2}\times2\frac{1}{2}$	$\frac{1}{4}$	3.60	0.69	0.96	1.14	1.24
	$\frac{1}{2}$	6.80	0.64	0.98	1.18	1.29

RADII OF GYRATION FOR TWO UNEQUAL LEGGED ANGLES, PLACED WITH LONGER LEGS BACK TO BACK.



Size. Inches.	Thickness, Inches.	Weight per foot of Single Angle. Lbs.	RADII OF GYRATION.			
			r_0	r_1	r_2	r_3
4 ×6	⅝	12.30	1.90	1.48	1.65	1.74
	1 1/16	25.40	1.83	1.54	1.73	1.83
3½ ×6	⅝	11.60	1.93	1.26	1.43	1.53
	1 1/16	24.00	1.86	1.33	1.52	1.62
4 ×5	⅝	11.00	1.59	1.58	1.75	1.85
	¾	21.00	1.48	1.62	1.81	1.91
3½ ×5	⅝	10.40	1.60	1.33	1.51	1.60
	¾	19.80	1.48	1.37	1.56	1.66
3 ×5	⅝	9.70	1.61	1.10	1.27	1.37
	¾	18.50	1.50	1.14	1.33	1.43
3½ ×4	⅝	9.10	1.25	1.43	1.60	1.70
	¾	17.20	1.15	1.46	1.65	1.75
3 ×4	⅝	8.50	1.25	1.17	1.35	1.44
	¾	15.90	1.16	1.22	1.42	1.52
2⅝ ×3½	⅝	7.70	1.19	1.02	1.20	1.30
	¾	14.30	1.10	1.06	1.27	1.37
3 ×3½	⅝	7.80	1.08	1.21	1.39	1.48
	¾	15.80	0.99	1.26	1.46	1.56
2½ ×3½	½	4.90	1.12	0.96	1.13	1.23
	⅝	9.40	1.05	0.98	1.17	1.27
2½ ×3	½	4.50	0.92	0.99	1.17	1.27
	⅝	8.50	0.86	1.01	1.21	1.31
2 ×3½	7/16	3.19	1.07	0.75	0.92	1.02
	½	8.10	0.97	0.77	0.97	1.08
2 ×3	7/16	3.10	0.97	0.75	0.93	1.03
	½	7.70	0.91	0.79	0.99	1.09
2 ×2½	7/16	2.80	0.79	0.79	0.97	1.07
	½	6.80	0.77	0.85	1.05	1.15

RADII OF GYRATION FOR TWO UNEQUAL LEGGED ANGLES, PLACED WITH SHORTER LEGS BACK TO BACK.



Size, Inches.	Thickness, Inches.	Weight per foot of Single Angle, Lbs.	RADII OF GYRATION.			
			r_0	r_1	r_2	r_3
4 ×6	⅜	12.30	1.14	2.71	2.90	2.99
	15/16	25.40	1.08	2.78	2.97	3.07
3½ ×6	⅜	11.60	0.98	2.81	3.00	3.09
	15/16	24.00	0.93	2.88	3.08	3.18
4 ×5	⅜	11.00	1.20	2.20	2.38	2.48
	¾	21.00	1.11	2.23	2.43	2.53
3½ ×5	⅜	10.40	1.02	2.27	2.45	2.55
	¾	19.80	0.93	2.29	2.49	2.58
3 ×5	⅜	9.70	0.85	2.35	2.52	2.62
	¾	18.50	0.77	2.37	2.57	2.67
3½ ×4	⅜	9.10	1.06	1.74	1.92	2.02
	¾	17.20	0.97	1.76	1.96	2.06
3 ×4	⅜	8.50	0.87	1.79	1.97	2.07
	¾	15.90	0.80	1.83	2.03	2.13
2⅝ ×3½	⅜	7.70	0.75	1.72	1.90	2.00
	¾	14.30	0.69	1.76	1.96	2.06
3 ×3½	⅜	7.80	0.88	1.52	1.71	1.80
	¾	15.80	0.81	1.56	1.76	1.87
2½ ×3½	½	4.90	0.74	1.58	1.76	1.86
	⅞	9.40	0.68	1.60	1.80	1.90
2½ ×3	½	4.50	0.73	1.29	1.48	1.58
	⅞	8.50	0.68	1.32	1.52	1.62
2 ×3½	5/16	3.19	0.59	1.53	1.72	1.82
	⅞	8.10	0.52	1.54	1.74	1.84
2 ×3	5/16	3.10	0.58	1.38	1.56	1.66
	½	7.70	0.54	1.41	1.61	1.72
2 ×2½	5/16	2.80	0.60	1.10	1.28	1.39
	½	6.80	0.58	1.17	1.37	1.48

SHEARING AND BEARING VALUE OF RIVETS.

Diam. of Rivet in inches, ⌀		Area of Rivet.	Single Shear at 6,000 lbs. per sq. in.	Bearing Value for different Thicknesses of Plate at 12,000 lbs. per square inch. (=Diameter of Rivet × Thickness of Plate × 12,000 lbs.)										
Fraction	Decimal			1/4″	5/16″	3/8″	7/16″	1/2″	9/16″	5/8″	11/16″	3/4″	13/16″	7/8″
3/8	.375	.1104	660	1130										
7/16	.4375	.1503	900	1810	1640									
1/2	.5	.1963	1180	1500	1880	2250								
9/16	.5625	.2485	1490	1690	2110	2530	2950							
5/8	.625	.3068	1840	1880	2340	2810	3280							
11/16	.6875	.3712	2230	2060	2580	3090	3610	4130						
3/4	.75	.4418	2650	2250	2810	3380	3940	4500	5060					
13/16	.8125	.5185	3110	2440	3050	3660	4260	4880	5480	6090				
7/8	.875	.6013	3610	2630	3280	3940	4590	5250	5910	6560				
15/16	.9375	.6903	4140	2810	3520	4220	4920	5630	6330	7030	7730			
1	1.	.7854	4710	3000	3750	4500	5250	6000	6750	7500	8250	9000		
1 1/16	1.0625	.8866	5320	3190	3980	4780	5580	6380	7190	7970	8770	9560	10360	
1 1/8	1.125	.9940	5960	3380	4220	5060	5910	6750	7590	8440	9280	10130	10970	11810
1 3/16	1.1875	1.1075	6650	3560	4450	5340	6230	7130	8020	8910	9800	10690	11580	12470

SHEARING AND BEARING VALUE OF RIVETS.

Diam. of Rivet in inches.		Area of Rivet.	Single Shear at 7,500 lbs. per sq. in.	Bearing Value for different Thicknesses of Plate at 15,000 lbs per square inch. (=Diameter of Rivet × Thickness of Plate × 15,000 lbs.)										
Fraction	Decimal			1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	11/16"	3/4"	13/16"	7/8"
3/8	.375	.1104	828	1410										
7/16	.4375	.1503	1130	1640	2050									
1/2	.5	.1963	1470	1880	2340	2810								
9/16	.5625	.2485	1860	2110	2640	3160	3690							
5/8	.625	.3068	2300	2340	2930	3520	4100							
11/16	.6875	.3712	2780	2580	3220	3870	4510	5160						
3/4	.75	.4418	3310	2810	3520	4220	4920	5630	6330					
13/16	.8125	.5185	3890	3050	3810	4570	5330	6090	6860	7620				
7/8	.875	.6013	4510	3280	4100	4920	5740	6560	7380	8200				
15/16	.9375	.6903	5180	3520	4390	5270	6150	7030	7910	8790	9670			
1	1.	.7854	5890	3750	4690	5620	6560	7500	8440	9380	10310	11250		
1 1/16	1.0625	.8866	6650	3980	4980	5980	6970	7970	8960	9960	10960	11950	12950	
1 1/8	1.125	.9940	7460	4220	5270	6330	7380	8440	9490	10550	11600	12660	13710	14770
1 3/16	1.1875	1.1075	8310	4450	5570	6680	7790	8910	10020	11130	12250	13360	14470	15590

STRENGTH OF MATERIALS.

ULTIMATE RESISTANCE TO TENSION.

IN LBS. PER SQUARE INCH.

METALS AND ALLOYS.

	AVERAGE.
Aluminum Bronze,	
10 per cent Al. and 90 per cent. Copper,	85000
1¼ " " 98¾ " "	28000
Brass, cast,	18000
" wire,	49000
Bronze or gun metal,	36000
Copper, cast,	19000
" sheet,	30000
" bolts,	36000
" wire, unannealed,	60000
Iron, cast, 13,400 to 29,000,	16500
" wrought, round or square bars of 1 to 2 inch diameter, double refined,	50000 to 54000
" wrought specimens ½ inch square, cut from large bars of double refined iron,	50000 to 53000
" wrought, double refined, in large bars of about 7 square inches section,	46000 to 47000
" wrought, universal mill plates, angles and other shapes,	48000 to 51000
" wrought plates over 36" wide,	46000 to 50000

The modulus of elasticity of double refined bar iron is 25,000,000 to 27,000,000.

Iron wire,	70000 to 100000
" wire ropes,	90000
Lead, sheet,	3300
Steel,	65000 to 120000
Tin, cast,	4600
Zinc,	7000 to 8000

STRENGTH OF MATERIALS—CONTINUED.

TIMBER, SEASONED, AND OTHER ORGANIC FIBER.

Taken largely from Trautwine's pocket book (edition of 1888).

	AVERAGE.
Ash, English,	17000
" American,	16000
Beach, "	15000 to 18000
Birch,	15000
Cedar of Lebanon,	11400
" American, red,	10300
Fir or Spruce,	10000
Hempen Ropes,	12000 to 16000
Hickory, American,	11000
Mahogany,	8000 to 21800
Oak, American white,	10000 to 18000
Oak, European,	10000 to 19800
Pine, American white, red and pitch, Memel, Riga,	10000
" " long leaf yellow,	12600 to 19200
Poplar,	7000
Silk fiber,	52000
Walnut, black,	16000

STONE, NATURAL AND ARTIFICIAL.

Brick and Cement,	280 to 800
Glass,	9400
Slate,	9600 to 12800
Mortar, ordinary,	50

ULTIMATE RESISTANCE TO COMPRESSION.

METALS.

Brass, cast,	10300
Iron, "	82000 to 145000
" wrought,	36000 to 40000

STEEL.

WEIGHTS OF FLAT ROLLED STEEL.

PER LINEAL FOOT.

For thicknesses from $\frac{1}{16}$ in. to 2 in. and widths from 1 in. to 12¾ in.

Thickness in inches.	1″	1½″	1⅓″	1¼″	2″	2½″	2⅓″	2¼″	12″
$\frac{1}{16}$	.638	.797	.957	1.11	1.28	1.44	1.59	1.75	7.65
$\frac{1}{8}$	.850	1.06	1.28	1.49	1.70	1.91	2.12	2.34	10.20
$\frac{3}{16}$	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	12.75
$\frac{1}{4}$	1.28	1.59	1.92	2.23	2.55	2.87	3.19	3.51	15.30
$\frac{5}{16}$	1.49	1.86	2.23	2.60	2.98	3.35	3.72	4.09	17.85
$\frac{3}{8}$	1.70	2.12	2.55	2.98	3.40	3.83	4.25	4.67	20.40
$\frac{7}{16}$	1.92	2.39	2.87	3.35	3.83	4.30	4.78	5.26	22.95
$\frac{1}{2}$	2.12	2.65	3.19	3.72	4.25	4.78	5.31	5.84	25.50
$\frac{9}{16}$	2.34	2.92	3.51	4.09	4.67	5.26	5.84	6.43	28.05
$\frac{5}{8}$	2.55	3.19	3.83	4.47	5.10	5.75	6.38	7.02	30.60
$\frac{11}{16}$	2.76	3.45	4.14	4.84	5.53	6.21	6.90	7.60	33.15
$\frac{3}{4}$	2.98	3.72	4.47	5.20	5.95	6.69	7.44	8.18	35.70
$\frac{13}{16}$	3.19	3.99	4.78	5.58	6.38	7.18	7.97	8.77	38.25
1	3.40	4.25	5.10	5.95	6.80	7.65	8.50	9.35	40.80
$1\frac{1}{16}$	3.61	4.52	5.42	6.32	7.22	8.13	9.03	9.93	43.35
$1\frac{1}{8}$	3.83	4.78	5.74	6.70	7.65	8.61	9.57	10.52	45.90
$1\frac{3}{16}$	4.04	5.05	6.06	7.07	8.08	9.09	10.10	11.11	48.45
$1\frac{1}{4}$	4.25	5.31	6.38	7.44	8.50	9.57	10.63	11.69	51.00
$1\frac{5}{16}$	4.46	5.58	6.69	7.81	8.93	10.04	11.16	12.27	53.55
$1\frac{3}{8}$	4.67	5 84	7.02	8.18	9.35	10.52	11.69	12.85	56.10
$1\frac{7}{16}$	4.89	6.11	7.34	8.56	9.78	11.00	12.22	13.44	58.65
$1\frac{1}{2}$	5.10	6.38	7.65	8.93	10.20	11.48	12.75	14.03	61.20
$1\frac{9}{16}$	5.32	6.64	7.97	9.30	10.63	11.95	13.28	14.61	63.75
$1\frac{5}{8}$	5.52	6.90	8.29	9.67	11.05	12.43	13.81	15.19	66.30
$1\frac{11}{16}$	5.74	7.17	8.61	10.04	11.47	12.91	14.34	15.78	68.85
$1\frac{3}{4}$	5.95	7.44	8.93	10.42	11.90	13.40	14.88	16.37	71.40
$1\frac{13}{16}$	6.16	7.70	9.24	10.79	12.33	13.86	15.40	16.95	73.95
$1\frac{7}{8}$	6.38	7.97	9.57	11.15	12.75	14.34	15.94	17.53	76.50
$1\frac{15}{16}$	6.59	8.24	9.88	11.53	13.18	14.83	16.47	18.12	79.05
2	6.80	8.50	10.20	11.90	13.60	15.30	17.00	18.70	81.60

STEEL.

WEIGHTS OF FLAT ROLLED STEEL.

PER LINEAL FOOT.

(CONTINUED.)

Thickness in inches.	3″	3½″	3¾″	3¾″	4″	4½″	4½″	4¾″	12″
1/16	1.91	2.07	2.23	2.39	2.55	2.71	2.87	3.03	7.65
1/8	2.55	2.76	2.98	3.19	3.40	3.61	3.83	4.04	10.20
3/16	3.19	3.45	3.72	3.99	4.25	4.52	4.78	5.05	12.75
1/4	3.83	4.15	4.47	4.78	5.10	5.42	5.74	6.06	15.30
5/16	4.46	4.83	5.20	5.58	5.95	6.32	6.70	7.07	17.85
3/8	5.10	5.53	5.95	6.38	6.80	7.22	7.65	8.08	20.40
7/16	5.74	6.22	6.70	7.17	7.65	8.13	8.61	9.09	22.95
1/2	6.38	6.91	7.44	7.97	8.50	9.03	9.57	10.10	25.50
9/16	7.02	7.60	8.18	8.76	9.35	9.93	10.52	11.11	28.05
5/8	7.65	8.29	8.93	9.57	10.20	10.84	11.48	12.12	30.60
11/16	8.29	8.98	9.67	10.36	11.05	11.74	12.43	13.12	33.15
3/4	8.93	9.67	10.41	11.16	11.90	12.65	13.39	14.13	35.70
13/16	9.57	10.36	11.16	11.95	12.75	13.55	14.34	15.14	38.25
1	10.20	11.05	11.90	12.75	13.60	14.45	15.30	16.15	40.80
1 1/16	10.84	11.74	12.65	13.55	14.45	15.35	16.26	17.16	43.35
1 1/8	11.48	12.43	13.39	14.34	15.30	16.26	17.22	18.17	45.90
1 3/16	12.12	13.12	14.13	15.14	16.15	17.16	18.17	19.18	48.45
1 1/4	12.75	13.81	14.87	15.94	17.00	18.06	19.13	20.19	51.00
1 5/16	13.39	14.50	15.62	16.74	17.85	18.96	20.08	21.20	53.55
1 3/8	14.03	15.20	16.36	17.53	18.70	19.87	21.04	22.21	56.10
1 7/16	14.66	15.88	17.10	18.33	19.55	20.77	21.99	23.22	58.65
1 1/2	15.30	16.58	17.85	19.13	20.40	21.68	22.95	24.23	61.20
1 9/16	15.94	17.27	18.60	19.92	21.25	22.58	23.91	25.24	63.75
1 5/8	16.58	17.96	19.34	20.72	22.10	23.48	24.87	26.25	66.30
1 11/16	17.22	18.65	20.08	21.51	22.95	24.38	25.82	27.26	68.85
1 3/4	17.85	19.34	20.83	22.32	23.80	25.29	26.78	28.27	71.40
1 13/16	18.49	20.03	21.57	23.11	24.65	26.19	27.73	29.27	73.95
1 7/8	19.13	20.72	22.31	23.91	25.50	27.10	28.69	30.28	76.50
1 15/16	19.77	21.41	23.06	24.70	26.35	28.00	29.64	31.29	79.05
2	20.40	22.10	23.80	25.50	27.20	28.90	30.60	32.30	81.60

STEEL.

WEIGHTS OF FLAT ROLLED STEEL.

PER LINEAL FOOT.

(CONTINUED.)

Thickness in inches.	5″	5¼″	5½″	5¾″	6″	6¼″	6½″	6¾″	12″
1/16	3.19	3.35	3.51	3.67	3.83	3.99	4.14	4.30	7.65
1/4	4.25	4.46	4.67	4.89	5.10	5.31	5.53	5.74	10.20
5/16	5.31	5.58	5.84	6.11	6.38	6.64	6.90	7.17	12.75
3/8	6.38	6.69	7.02	7.34	7.65	7.97	8.29	8.61	15.30
7/16	7.44	7.81	8.18	8.56	8.93	9.29	9.67	10.04	17.85
1/2	8.50	8.93	9.35	9.77	10.20	10.63	11.05	11.48	20.40
9/16	9.57	10.04	10.52	11.00	11.48	11.95	12.43	12.91	22.95
5/8	10.63	11.16	11.69	12.22	12.75	13.28	13.81	14.34	25.50
11/16	11.69	12.27	12.85	13.44	14.03	14.61	15.20	15.78	28.05
3/4	12.75	13.39	14.03	14.67	15.30	15.94	16.58	17.22	30.60
13/16	13.81	14.50	15.19	15.88	16.58	17.27	17.95	18.65	33.15
7/8	14.87	15.62	16.36	17.10	17.85	18.60	19.34	20.08	35.70
15/16	15.94	16.74	17.53	18.33	19.13	19.92	20.72	21.51	38.25
1	17.00	17.85	18.70	19.55	20.40	21.25	22.10	22.95	40.80
1 1/16	18.06	18.96	19.87	20.77	21.68	22.58	23.48	24.39	43.35
1 1/8	19.13	20.08	21.04	21.99	22.95	23.91	24.87	25.82	45.90
1 3/16	20.19	21.20	22.21	23.22	24.23	25.23	26.24	27.25	48.45
1 1/4	21.25	22.32	23.38	24.44	25.50	26.56	27.62	28.69	51.00
1 5/16	22.32	23.48	24.54	25.66	26.78	27.90	29.01	30.12	53.55
1 3/8	23.38	24.54	25.71	26.88	28.05	29.22	30.39	31.56	56.10
1 7/16	24.44	25.66	26.88	28.10	29.33	30.55	31.77	32.99	58.65
1 1/2	25.50	26.78	28.05	29.33	30.60	31.88	33.15	34.43	61.20
1 9/16	26.57	27.89	29.22	30.55	31.88	33.20	34.53	35.86	63.75
1 5/8	27.63	29.01	30.39	31.77	33.15	34.53	35.91	37.29	66.30
1 11/16	28.69	30.12	31.55	32.99	34.43	35.86	37.30	38.73	68.85
1 3/4	29.75	31.24	32.73	34.22	35.70	37.19	38.68	40.17	71.40
1 13/16	30.81	32.35	33.89	35.43	36.98	38.52	40.05	41.60	73.95
1 7/8	31.87	33.47	35.06	36.65	38.25	39.85	41.44	43.03	76.50
1 15/16	32.94	34.59	36.23	37.88	39.53	41.17	42.82	44.46	79.05
2	34.00	35.70	37.40	39.10	40.80	42.50	44.20	45.90	81.60

STEEL.

WEIGHTS OF FLAT ROLLED STEEL.

PER LINEAL FOOT.

(CONTINUED.)

Thickness in inches.	7″	7¼″	7½″	7¾″	8″	8¼″	8½″	8¾″	12″
1/16	4.46	4.62	4.78	4.94	5.10	5.26	5.42	5.58	7.65
1/8	5.95	6.16	6.36	6.58	6.80	7.01	7.22	7.43	10.20
3/16	7.44	7.70	7.97	8.23	8.50	8.76	9.03	9.29	12.75
1/4	8.93	9.25	9.57	9.88	10.20	10.52	10.84	11.16	15.30
5/16	10.41	10.78	11.16	11.53	11.90	12.27	12.64	13.02	17.85
3/8	11.90	12.32	12.75	13.18	13.60	14.03	14.44	14.87	20.40
7/16	13.39	13.86	14.34	14.82	15.30	15.78	16.26	16.74	22.95
1/2	14.87	15.40	15.94	16.47	17.00	17.53	18.06	18.59	25.50
9/16	16.36	16.94	17.53	18.12	18.70	19.28	19.86	20.45	28.05
5/8	17.85	18.49	19.13	19.77	20.40	21.04	21.68	22.32	30.60
11/16	19.34	20.03	20.72	21.41	22.10	22.79	23.48	24.17	33.15
3/4	20.83	21.57	22.32	23.05	23.80	24.55	25.30	26.04	35.70
13/16	22.32	23.11	23.91	24.70	25.50	26.30	27.10	27.89	38.25
1	23.80	24.65	25.50	26.35	27.20	28.05	28.90	29.75	40.80
1 1/16	25.29	26.19	27.10	28.00	28.90	29.80	30.70	31.61	43.35
1 1/8	26.78	27.73	28.68	29.64	30.60	31.56	32.52	33.47	45.90
1 3/16	28.26	29.27	30.28	31.29	32.30	33.31	34.32	35.33	48.45
1 1/4	29.75	30.81	31.88	32.94	34.00	35.06	36.12	37.20	51.00
1 5/16	31.23	32.35	33.48	34.59	35.70	36.81	37.93	39.05	53.55
1 3/8	32.72	33.89	35.06	36.23	37.40	38.57	39.74	40.91	56.10
1 7/16	34.21	35.44	36.66	37.88	39.10	40.32	41.54	42.77	58.65
1 1/2	35.70	36.98	38.26	39.53	40.80	42.08	43.35	44.63	61.20
1 9/16	37.19	38.51	39.84	41.17	42.50	43.83	45.16	46.49	63.75
1 5/8	38.67	40.05	41.44	42.82	44.20	45.58	46.96	48.34	66.30
1 11/16	40.16	41.59	43.08	44.47	45.90	47.33	48.76	50.20	68.85
1 3/4	41.65	43.14	44.63	46.12	47.60	49.09	50.58	52.07	71.40
1 13/16	43.14	44.68	46.22	47.76	49.30	50.84	52.38	53.92	73.95
1 7/8	44.63	46.22	47.82	49.40	51.00	52.60	54.20	55.79	76.50
1 15/16	46.12	47.76	49.41	51.05	52.70	54.35	56.00	57.64	79.05
2	47.60	49.30	51.00	52.70	54.40	56.10	57.80	59.50	81.60

STEEL.

WEIGHTS OF FLAT ROLLED STEEL.

PER LINEAL FOOT.

(CONTINUED.)

Thickness in inches.	9″	9⅛″	9¼″	9⅜″	10″	10⅛″	10¼″	10⅜″	12″
1/16	5.74	5.90	6.06	6.22	6.38	6.54	6.70	6.86	7.65
1/8	7.65	7.86	8.08	8.29	8.50	8.71	8.92	9.14	10.20
3/16	9.56	9.83	10.10	10.36	10.62	10.89	11.16	11.42	12.75
1/4	11.48	11.80	12.12	12.44	12.75	13.07	13.39	13.71	15.30
5/16	13.40	13.76	14.14	14.51	14.88	15.25	15.62	15.99	17.85
3/8	15.30	15.73	16.16	16.58	17.00	17.42	17.85	18.28	20.40
7/16	17.22	17.69	18.18	18.65	19.14	19.61	20.08	20.56	22.95
1/2	19.13	19.65	20.19	20.72	21.25	21.78	22.32	22.85	25.50
9/16	21.04	21.62	22.21	22.79	23.38	23.96	24.54	25.13	28.05
5/8	22.96	23.59	24.23	24.86	25.50	26.14	26.78	27.42	30.60
11/16	24.86	25.55	26.24	26.94	27.62	28.32	29.00	29.69	33.15
3/4	26.78	27.52	28.26	29.01	29.75	30.50	31.24	31.98	35.70
13/16	28.69	29.49	30.28	31.08	31.88	32.67	33.48	34.28	38.25
1	30.60	31.45	32.30	33.15	34.00	34.85	35.70	36.55	40.80
1 1/16	32.52	33.41	34.32	35.22	36.12	37.03	37.92	38.83	43.35
1 1/8	34.43	35.38	36.34	37.29	38.25	39.21	40.17	41.12	45.90
1 3/16	36.34	37.35	38.36	39.37	40.38	41.39	42.40	43.40	48.45
1 1/4	38.26	39.31	40.37	41.44	42.50	43.56	44.63	45.69	51.00
1 5/16	40.16	41.28	42.40	43.52	44.64	45.75	46.86	47.97	53.55
1 3/8	42.08	43.25	44.41	45.58	46.75	47.92	49.08	50.25	56.10
1 7/16	44.00	45.22	46.44	47.66	48.88	50.10	51.32	52.54	58.65
1 1/2	45.90	47.18	48.45	49.73	51.00	52.28	53.55	54.83	61.20
1 9/16	47.82	49.14	50.48	51.80	53.14	54.46	55.78	57.11	63.75
1 5/8	49.73	51.10	52.49	53.87	55.25	56.63	58.02	59.40	66.30
1 11/16	51.64	53.07	54.51	55.94	57.38	58.81	60.24	61.68	68.85
1 3/4	53.56	55.04	56.53	58.01	59.50	60.99	62.48	63.97	71.40
1 13/16	55.46	57.00	58.54	60.09	61.62	63.17	64.70	66.24	73.95
1 7/8	57.38	58.97	60.56	62.16	63.75	65.35	66.94	68.53	76.50
1 15/16	59.29	60.94	62.58	64.23	65.88	67.52	69.18	70.83	79.05
2	61.20	62.90	64.60	66.30	68.00	69.70	71.40	73.10	81.60

STEEL.

WEIGHTS OF FLAT ROLLED STEEL.

PER LINEAL FOOT.

(CONTINUED.)

Thickness in inches.	11″	11¼″	11½″	11¾″	12″	12¼″	12½″	12¾″
3/16	7.02	7.17	7.32	7.49	7.65	7.82	7.98	8.13
1/4	9.34	9.57	9.78	10.00	10.20	10.42	10.63	10.84
5/16	11.68	11.95	12.22	12.49	12.75	13.01	13.28	13.55
3/8	14.03	14.35	14.68	14.99	15.30	15.62	15.94	16.26
7/16	16.36	16.74	17.12	17.49	17.85	18.23	18.60	18.97
1/2	18.70	19.13	19.55	19.97	20.40	20.82	21.25	21.67
9/16	21.02	21.51	22.00	22.48	22.95	23.43	23.90	24.39
5/8	23.38	23.91	24.44	24.97	25.50	26.03	26.56	27.09
11/16	25.70	26.30	26.88	27.47	28.05	28.64	29.22	29.80
3/4	28.05	28.68	29.33	29.97	30.60	31.25	31.88	32.52
13/16	30.40	31.08	31.76	32.46	33.15	33.83	34.53	35.22
7/8	32.72	33.47	34.21	34.95	35.70	36.44	37.19	37.93
15/16	35.06	35.86	36.66	37.46	38.25	39.05	39.84	40.64
1	37.40	38.25	39.10	39.95	40.80	41.65	42.50	43.35
1 1/16	39.74	40.64	41.54	42.45	43.35	44.25	45.16	46.06
1 1/8	42.08	43.04	44.00	44.94	45.90	46.86	47.82	48.77
1 3/16	44.42	45.42	46.44	47.45	48.45	49.46	50.46	51.48
1 1/4	46.76	47.82	48.88	49.94	51.00	52.06	53.12	54.19
1 5/16	49.08	50.20	51.32	52.44	53.55	54.67	55.78	56.90
1 3/8	51.42	52.59	53.76	54.93	56.10	57.27	58.44	59.60
1 7/16	53.76	54.99	56.21	57.43	58.65	59.87	61.10	62.32
1 1/2	56.10	57.37	58.65	59.93	61.20	62.48	63.75	65.03
1 9/16	58.42	59.76	61.10	62.43	63.75	65.08	66.40	67.74
1 5/8	60.78	62.16	63.54	64.92	66.30	67.68	69.06	70.44
1 11/16	63.10	64.55	65.98	67.42	68.85	70.29	71.72	73.15
1 3/4	65.45	66.93	68.43	69.92	71.40	72.90	74.38	75.87
1 13/16	67.80	69.33	70.86	72.41	73.95	75.48	77.03	78.57
1 7/8	70.12	71.72	73.31	74.90	76.50	78.09	79.69	81.28
1 15/16	72.46	74.11	75.76	77.41	79.05	80.70	82.34	83.99
2	74.80	76.50	78.20	79.90	81.60	83.30	85.00	86.70

The weights for 12″ width are repeated on each page to facilitate making the additions necessary to obtain the weights of plates wider than 12″. Thus to find the weight of 15½″×⅜″, add the weights to be found in the same line for 3½″×⅜″ and 12″×⅜″=10.41+35.70=46.11 lbs.

WEIGHTS AND AREAS OF SQUARE AND ROUND STEEL, ALSO CIRCUMFERENCE OF ROUND BARS.

Assuming one cubic foot to weigh 490 lbs.

Thickness or Diameter in Inches.	Weight of Square Bar 1 ft. long.	Weight of Round Bar 1 ft. long.	Area of Square Bar in Square Inches.	Area of Round Bar in Square Inches.	Circumference of Round Bar in Inches.
3/16	.120	.094	.0352	.0276	.5890
1/4	.213	.167	.0625	.0491	.7854
5/16	.332	.261	.0977	.0767	.9817
3/8	.478	.375	.1406	.1104	1.1781
7/16	.651	.511	.1914	.1503	1.3744
1/2	.851	.668	.2500	.1963	1.5708
9/16	1.076	.845	.3164	.2485	1.7671
5/8	1.329	1.044	.3906	.3068	1.9635
11/16	1.608	1.263	.4727	.3712	2.1598
3/4	1.914	1.503	.5625	.4418	2.3562
13/16	2.246	1.764	.6602	.5185	2.5525
7/8	2.605	2.046	.7656	.6013	2.7489
15/16	2.990	2.348	.8789	.6903	2.9452
1	3.402	2.672	1.0000	.7854	3.1416
1 1/16	3.841	3.017	1.1289	.8866	3.3379
1 1/8	4.306	3.382	1.2656	.9940	3.5343
1 3/16	4.798	3.768	1.4102	1.1075	3.7306
1 1/4	5.316	4.175	1.5625	1.2272	3.9270
1 5/16	5.861	4.603	1.7227	1.3530	4.1233
1 3/8	6.432	5.052	1.8906	1.4849	4.3197
1 7/16	7.030	5.521	2.0664	1.6230	4.5160
1 1/2	7.655	6.012	2.2500	1.7671	4.7124
1 9/16	8.306	6.524	2.4414	1.9175	4.9087
1 5/8	8.984	7.056	2.6406	2.0739	5.1051
1 11/16	9.688	7.609	2.8477	2.2365	5.3014
1 3/4	10.419	8.183	3.0625	2.4053	5.4978
1 13/16	11.177	8.778	3.2852	2.5802	5.6941
1 7/8	11.961	9.394	3.5156	2.7612	5.8905
1 15/16	12.772	10.031	3.7539	2.9483	6.0868

WEIGHTS AND AREAS OF SQUARE AND ROUND STEEL,
ALSO CIRCUMFERENCE OF ROUND BARS.

Assuming one cubic foot to weigh 490 lbs.

Thickness or Diameter in Inches.	Weight of Square Bar 1 ft. long.	Weight of Round Bar 1 ft. long.	Area of Square Bar in Square Inches.	Area of Round Bar in Square Inches.	Circumference of Round Bar in Inches.
2	13.61	10.69	4.0000	3.1416	6.2832
1/16	14.47	11.36	4.2539	3.3410	6.4795
1/8	15.36	12.06	4.5156	3,5466	6.6759
3/16	16.28	12.79	4.7852	3.7583	6.8722
1/4	17.22	13.52	5.0625	3.9761	7.0686
5/16	18.19	14.29	5.3477	4.2000	7.2649
3/8	19.19	15.07	5.6406	4.4301	7.4613
7/16	20.21	15.87	5.9414	4.6664	7.6576
1/2	21.26	16.70	6.2500	4.9087	7.8540
9/16	22.34	17.55	6.5664	5.1572	8.0503
5/8	23.44	18.41	6.8906	5.4119	8.2467
11/16	24.57	19.30	7.2227	5.6727	8.4430
3/4	25.73	20.21	7.5625	5.9396	8.6394
13/16	26.91	21.14	7.9102	6.2126	8.8357
7/8	28.12	22.09	8.2656	6.4918	9.0321
15/16	29.36	23.06	8.6289	6.7771	9.2284
3	30.62	24.05	9.0000	7.0686	9.4248
1/16	31.91	25.06	9.3789	7.3662	9.6211
1/8	33.23	26.10	9.7656	7.6699	9.8175
3/16	34.57	27.15	10.160	7.9798	10.014
1/4	35.94	28.23	10.563	8.2958	10.210
5/16	37.33	29.32	10.973	8.6179	10.407
3/8	38.75	30.43	11.391	8.9462	10.603
7/16	40.20	31.57	11.816	9.2806	10.799
1/2	41.68	32.74	12.250	9.6211	10.996
9/16	43.17	33.91	12.691	9.9678	11.192
5/8	44.71	35.12	13.141	10.321	11.388
11/16	46.26	36.33	13.598	10.680	11.585
3/4	47.84	37.57	14.063	11.045	11.781
13/16	49.45	38.84	14.535	11.416	11.977
7/8	51.09	40.13	15.016	11.793	12.174
15/16	52.75	41.43	15.504	12.177	12.370

WEIGHTS AND AREAS OF SQUARE AND ROUND STEEL, ALSO CIRCUMFERENCE OF ROUND BARS.

Assuming one cubic foot to weigh 490 lbs.

Thickness or Diameter in Inches.	Weight of Square Bar 1 ft. long.	Weight of Round Bar 1 ft. long.	Area of Square Bar in Square Inches.	Area of Round Bar in Square Inches.	Circumference of Round Bar in Inches.
4	54.45	42.77	16.000	12.566	12.566
1/8	57.90	45.47	17.016	13.364	12.959
1/4	61.47	48.28	18.063	14.186	13.352
3/8	65.13	51.15	19.141	15.033	13.744
1/2	69.81	54.83	20.250	15.904	14.137
5/8	72.79	57.17	21.391	16.800	14.530
3/4	76.78	60.30	22.563	17.721	14.923
7/8	80.87	63.52	23.766	18.665	15.315
5	85.08	66.82	25.000	19.635	15.708
1/8	89.38	70.20	26.266	20.629	16.101
1/4	93.80	73.67	27.563	21.648	16.493
3/8	98.31	77.21	28.891	22.691	16.886
1/2	102.94	80.85	30.250	23.758	17.279
5/8	107.67	84.56	31.641	24.850	17.671
3/4	112.52	88.37	33.063	25.967	18.064
7/8	117.45	92.25	34.516	27.109	18.457
6	122.51	96.22	36.000	28.274	18.850
1/8	127.66	100.26	37.516	29.465	19.242
1/4	132.94	104.41	39.063	30.680	19.635
3/8	138.30	108.62	40.641	31.919	20.028
1/2	143.78	112.92	42.250	33.183	20.420
5/8	149.35	117.30	43.891	34.472	20.813
3/4	155.05	121.78	45.563	35.785	21.206
7/8	160.84	125.32	47.266	37.122	21.598
7	166.75	130.97	49.000	38.485	21.991
1/8	172.75	135.68	50.766	39.871	22.384
1/4	178.87	140.48	52.563	41.282	22.777
3/8	185.08	145.36	54.391	42.718	23.169
1/2	191.42	150.34	56.250	44.179	23.562
5/8	197.85	155.39	58.141	45.664	23.955
3/4	204.39	160.53	60.063	47.173	24.347
7/8	211.03	165.74	62.016	48.707	24.740

WEIGHTS AND AREAS OF SQUARE AND ROUND STEEL, ALSO CIRCUMFERENCE OF ROUND BARS.

Assuming one cubic foot to weigh 490 lbs.

Thickness or Diameter in Inches.	Weight of Square Bar 1 ft. long.	Weight of Round Bar 1 ft. long.	Area of Square Bar in Square Inches.	Area of Round Bar in Square Inches.	Circumference of Round Bar in Inches.
8	217.78	171.04	64.000	50.265	25.133
1/8	224.64	176.43	66.016	51.849	25.525
1/4	231.61	181.91	68.063	53.456	25.918
3/8	238.68	187.46	70.141	55.088	26.311
1/2	245.86	193.10	72.250	56.745	26.704
5/8	253.14	198.82	74.391	58.426	27.096
3/4	260.54	204.63	76.563	60.132	27.489
7/8	268.03	210.51	78.766	61.862	27.882
9	275.64	216.49	81.000	63.617	28.274
1/8	283.34	222.54	83.266	65.397	28.667
1/4	291.16	228.68	85.563	67.201	29.060
3/8	299.08	234.90	87.891	69.029	29.452
1/2	307.11	241.20	90.250	70.882	29.845
5/8	315.24	247.59	92.641	72.760	30.238
3/4	323.49	254.07	95.063	74.662	30.631
7/8	331.83	260.62	97.516	76.589	31.023
10	340.29	267.16	100.00	78.540	31.416
1/8	348.85	273.99	102.52	80.516	31.809
1/4	357.52	280.80	105.06	82.516	32.201
3/8	366.29	287.68	107.64	84.541	32.594
1/2	375.17	294.66	110.25	86.590	32.987
5/8	384.15	301.71	112.89	88.664	33.379
3/4	393.25	308.86	115.56	90.763	33.772
7/8	402.44	316.08	118.27	92.886	34.165
11	411.75	323.39	121.00	95.033	34.558
1/8	421.16	330.78	123.77	97.205	34.950
1/4	430.68	338.26	126.56	99.402	35.343
3/8	440.30	345.81	129.39	101.62	35.739
1/2	450.03	353.45	132.25	103.87	36.128
5/8	459.87	361.18	135.14	106.14	36.521
3/4	469.81	368.99	138.06	108.43	36.914
7/8	479.86	376.88	141.02	110.75	37.306

AVERAGE WEIGHT OF ROUND HEADED RIVETS PER 100.

LENGTH FROM UNDER HEAD.

Length. Inches.	Diameter.							
	⅜	½	⅝	¾	⅞	1	1⅛	1¼
1½	5.5	12.9	21.9	29.3	44.0	66.6	93.3	125.5
1⅝	6.3	14.2	24.2	32.4	48.2	72.1	100.4	135.7
1¾	7.0	15.6	26.3	35.6	52.4	77.7	107.1	144.8
2	7.9	16.9	28.4	38.7	56.7	83.2	114.2	153.0
2¼	8.7	18.4	30.6	41.8	61.0	88.8	121.4	162.2
2½	9.4	19.8	32.8	45.0	64.3	94.4	128.5	170.3
2¾	10.2	21.1	35.0	48.0	69.5	100.0	135.7	179.5
3	11.0	22.5	37.1	51.2	73.7	105.1	142.8	187.7
3¼	11.7	24.0	39.4	54.4	78.0	111.2	149.9	196.9
3½	12.5	25.3	41.5	57.5	82.3	116.3	157.1	205.0
3¾	13.4	26.7	43.7	60.6	86.5	122.4	164.2	214.2
4	14.1	28.1	45.9	63.8	90.8	127.5	170.3	222.4
4¼	14.9	29.5	48.0	66.9	95.1	133.6	177.5	231.5
4½	15.7	30.9	50.2	70.0	99.3	138.7	184.6	240.7
4¾	16.5	32.2	52.4	73.1	104.0	144.8	191.8	248.9
5	17.2	33.7	54.6	76.3	108.1	149.9	198.9	258.1
5¼	18.1	35.1	56.7	79.4	112.2	156.1	206.0	266.2
5½	18.8	36.4	58.9	82.5	116.3	161.2	213.2	275.4
5¾	19.6	37.8	61.1	85.7	120.4	166.3	220.3	283.6
6	20.4	39.3	63.2	88.7	124.4	172.4	227.5	292.7
6½	21.9	42.0	67.6	95.1	133.6	183.6	240.7	310.1
7	23.5	44.8	71.9	101.3	141.8	194.8	255.0	327.4
7½	25.1	47.5	76.3	108.1	149.9	206.0	269.3	344.8
8	26.6	50.4	80.6	114.2	159.1	217.3	283.6	362.1
8½	28.2	53.1	85.0	120.3	167.3	227.5	297.8	379.4
9	29.8	55.9	89.4	126.5	176.5	238.7	312.1	396.8
9½	31.3	58.8	93.6	132.6	184.6	249.9	325.4	410.1
10	32.8	61.5	98.0	138.7	192.8	261.1	339.7	431.5
Heads....	1.8	5.8	11.1	13.7	22.6	38.8	58.1	83.6

AVERAGE WEIGHT OF SQUARE HEAD MACHINE BOLTS PER 100.

Length.	DIAMETER.								
	¼	5/16	⅜	7/16	½	⅝	¾	⅞	1
1½	4.0	6.8	10.6	15.0	23.9	40.5	70.0	.....	.....
1¾	4.4	7.8	11.8	16.1	25.1	42.7	73.1	.....	.....
2	4.7	7.8	12.0	17.2	26.3	44.8	76.2	.....	.....
2¼	5.1	8.4	12.6	18.2	27.7	47.0	79.3	.....	.....
2½	5.4	8.9	13.3	19.2	29.0	49.2	82.4	120.5	.....
2¾	5.8	9.5	14.0	20.2	30.4	51.4	85.5	124.7	.....
3	6.1	10.0	14.7	21.2	31.8	53.5	88.7	128.9	185.0
3½	6.8	11.1	16.0	23.2	34.7	57.9	95.0	137.4	196.0
4	7.5	12.2	17.4	25.2	37.5	62.3	101.2	145.8	207.0
4½	8.2	13.2	18.7	27.2	40.2	66.7	107.5	159.2	218.0
5	8.9	14.3	20.0	29.1	43.0	71.0	113.7	167.7	229.0
5½	9.6	15.4	21.4	31.2	45.7	75.4	120.0	176.1	240.0
6	10.8	16.5	22.8	33.1	48.4	79.8	126.2	184.6	251.0
6½	11.0	17.6	24.1	35.1	51.2	84.1	132.5	193.0	262.0
7	11.7	18.6	25.9	37.1	54.0	88.5	138.7	201.4	273.0
7½	12.4	19.7	27.7	39.1	56.7	92.9	145.0	209.9	284.0
8	13.1	20.8	29.5	41.0	59.4	97.2	151.2	218.3	295.0
9	.....	.....	33.1	45.0	64.8	106.0	163.7	240.2	317.0
10	.....	.....	36.7	49.0	70.3	114.7	176.2	257.1	339.0
11	.....	.....	40.4	53.0	75.8	123.5	188.7	273.9	360.0
12	.....	.....	44.0	57.0	81.3	132.2	201.0	290.0	382.0
13	.....	.....	.....	.....	86.7	140.7	213.4	307.7	404.0
14	.....	.....	.....	.....	92.2	149.2	225.9	324.5	426.0
15	.....	.....	.....	.....	97.7	157.6	238.3	341.4	448.0
16	.....	.....	.....	.....	103.1	166.1	250.8	358.3	470.0
17	.....	.....	.....	.....	108.6	174.6	263.2	375.2	492.0
18	.....	.....	.....	.....	114.1	183.1	275.6	392.0	514.0
19	.....	.....	.....	.....	119.5	191.5	288.1	408.9	536.0
20	.....	.....	.....	.....	125.0	200.0	300.5	425.8	558.0
Per inch additional.	1.4	2.2	3.6	4.0	5.5	8.5	12.4	16.9	22.0

APPROXIMATE WEIGHT OF NUTS AND BOLT HEADS, IN POUNDS.

Diam. of Bolt in inches,	¼	5/16	⅜	7/16	½	⅝	¾
Weight of Hexagon Nut and Head	.017	.042	.057	.109	.128	.267	.43
Weight of Square Nut and Head	.021	.049	.069	.120	.164	.320	.55

Diam. of Bolt in inches.	⅞	1	1¼	1½	1¾	2	2½
Weight of Hexagon Nut and Head	.73	1.10	2.14	3.78	5.6	8.75	17.0
Weight of Square Nut and Head	.88	1.31	2.56	4.42	7.0	10.5	21.0

SIZES AND WEIGHTS OF HOT PRESSED SQUARE NUTS, UNITED STATES STANDARD SIZES.

Both weights and sizes are for unfinished nuts.

Width.	Thickness.	Size of Hole.		Size of Bolt.	Weight of 100 Nuts.	Number of Nuts in 100 lbs.
1/2	1/4	0.185	5/16 scant.	1/4	1.4	7270
19/32	5/16	0.240	1/4 "	5/16	2.2	4700
11/16	3/8	0.294	19/64 "	3/8	4.3	2350
25/32	7/16	0.344	11/32	7/16	6.1	1630
7/8	1/2	0.400	13/32 scant.	1/2	9.0	1120
31/32	9/16	0.454	29/64 "	9/16	11.2	890
1 1/16	5/8	0.507	1/2 full.	5/8	15.6	640
1 1/4	3/4	0.620	5/8 scant.	3/4	26.3	380
1 7/16	7/8	0.731	47/64 scant.	7/8	35.7	280
1 5/8	1	0.837	27/32 "	1	58.8	170
1 13/16	1 1/8	0.940	15/16 full.	1 1/8	76.9	130
2	1 1/4	1.065	1 1/16 "	1 1/4	104.2	96
2 3/16	1 3/8	1.160	1 5/32 full.	1 3/8	142.8	70
2 3/8	1 1/2	1.284	1 9/32 "	1 1/2	172.4	58
2 9/16	1 5/8	1.389	1 25/64 scant.	1 5/8	227.3	44
2 3/4	1 3/4	1.491	1 1/3 "	1 3/4	294.1	34
2 15/16	1 7/8	1.616	1 5/8 scant.	1 7/8	370.4	27
3 1/8	2	1.712	1 23/32 "	2	416.7	24
3 5/16	2 1/8	1.836	1 27/32 "	2 1/8	500.0	20
3 1/2	2 1/4	1.962	1 31/32 "	2 1/4	588.2	17

SIZES AND WEIGHTS OF HOT PRESSED HEXAGON NUTS, UNITED STATES STANDARD SIZES.

Both weights and sizes are for unfinished Nuts.

Width.	Thickness.	Size of Hole.		Size of Bolt.	Weight of 100 Nuts.	Number of Nuts in 100 lbs.
1/4	1/4	0.185	9/16 scant.	1/4	1.3	7615
19/32	5/16	0.240	1/2 "	5/16	1.9	5200
11/16	3/8	0.294	19/64 "	3/8	3.3	3000
21/32	7/16	0.344	11/32	7/16	5.0	2000
7/8	1/2	0.400	13/32 scant.	1/2	7.0	1430
31/32	9/16	0.454	29/64	9/16	9.1	1100
1 1/16	5/8	0.507	1/2 full.	5/8	13.5	740
1 1/4	3/4	0.620	5/8 scant.	3/4	22.2	450
1 7/16	7/8	0.731	47/64 scant.	7/8	32.4	309
1 5/8	1	0.837	27/32 "	1	46.3	216
1 13/16	1 1/8	0.940	15/16 full.	1 1/8	67.6	148
2	1 1/4	1.065	1 1/16 "	1 1/4	90.1	111
2 3/16	1 3/8	1.160	1 5/32 full.	1 3/8	117.5	85
2 3/8	1 1/2	1.284	1 9/32 "	1 1/2	147.1	68
2 9/16	1 5/8	1.389	1 13/64 scant.	1 5/8	178.6	56
2 3/4	1 3/4	1.491	1 1/2 "	1 3/4	250.0	40
2 15/16	1 7/8	1.616	1 5/8 scant.	1 7/8	285.7	35
3 1/8	2	1.712	1 23/32 "	2	344.8	29
3 5/16	2 1/8	1.836	1 27/32 "	2 1/8	384.6	26
3 1/2	2 1/4	1.962	1 31/32 "	2 1/4	434.8	23

UPSET SCREW ENDS,
FOR ROUND AND SQUARE BARS.

Dia. of Round or Side of Square Bar. Inches.	ROUND BARS. Dia. of Upset Screw End. Inches.	Dia. of Screw at Root of Thread. Inches.	Threads per Inch No.	Excess of Effective Area of Screw End over Bar. Per Cent.	SQUARE BARS. Dia. of Upset Screw End. Inches.	Dia. of Screw at Root of Thread. Inches.	Threads per Inch. No.	Excess of Effective Area of Screw End over Bar. Per Cent.
1/4	1/2	.620	10	54	1/2	.620	10	21
9/16	1/2	.620	10	21	7/8	.781	9	33
1/2	7/8	.731	9	37	1	837	8	41
11/16	1	.837	8	48	1	.837	8	17
3/4	1	.837	8	25	1 1/8	.940	7	23
13/16	1 1/8	.940	7	34	1 1/4	1.065	7	35
7/8	1 1/4	1.065	7	48	1 3/8	1.160	6	38
15/16	1 1/4	1.065	7	29	1 3/8	1.160	6	20
1	1 3/8	1.160	6	35	1 1/2	1.284	6	29
1 1/16	1 3/8	1.160	6	19	1 5/8	1.389	5 1/2	34
1 1/8	1 1/2	1.284	6	30	1 5/8	1.389	5 1/2	20
1 3/16	1 1/2	1.284	6	17	1 3/4	1.490	5	24
1 1/4	1 5/8	1.389	5 1/2	23	1 7/8	1.615	5	31
1 5/16	1 3/4	1.490	5	29	1 7/8	1.615	5	19
1 3/8	1 3/4	1.490	5	18	2	1.712	4 1/2	22
1 7/16	1 7/8	1.615	5	26	2 1/8	1.837	4 1/2	28
1 1/2	2	1.712	4 1/2	30	2 1/8	1.837	4 1/2	18
1 9/16	2	1.712	4 1/2	20	2 1/4	1.962	4 1/2	24
1 5/8	2 1/8	1.837	4 1/2	28	2 3/8	2.087	4 1/2	30
1 11/16	2 1/8	1.837	4 1/2	18	2 3/8	2.087	4 1/2	20
1 3/4	2 1/4	1.962	4 1/2	26	2 1/2	2.175	4	21
1 13/16	2 1/4	1.962	4 1/2	17	2 5/8	2.300	4	26
1 7/8	2 3/8	2.087	4 1/2	24	2 5/8	2.300	4	18
1 15/16	2 1/2	2.175	4	26	2 3/4	2.425	4	23
2	2 1/2	2.175	4	18	2 7/8	2.550	4	28
2 1/16	2 5/8	2.300	4	24	2 7/8	2.550	4	20
2 1/8	2 3/4	2.300	4	17	3	2.629	3 1/2	20
2 3/16	2 3/4	2.425	4	23	3 1/8	2.754	3 1/2	24

UPSET SCREW ENDS—CONTINUED.

Dia. of Round or Side of Square Bar. Inches.	ROUND BARS. Dia. of Upset Screw End. Inches.	Dia. of Screw at Root of Thread. Inches.	Threads per Inch. No.	Excess of Effective Area of Screw End over Bar. Per cent.	SQUARE BARS. Dia. of Upset Screw End. Inches.	Dia. of Screw at Root of Thread. Inches.	Threads per Inch. No.	Excess of Effective Area of Screw End over Bar. Per Cent.
2 1/2	2 7/8	2.550	4	28	3 1/8	2.754	3 1/2	18
2 5/16	2 7/8	2.550	4	22	3 1/4	2.879	3 1/2	22
2 3/8	3	2.629	3 1/2	23	3 3/8	3.004	3 1/2	26
2 7/16	3 1/8	2.754	3 1/2	28	3 3/8	3.004	3 1/2	19
2 1/2	3 1/8	2.754	3 1/2	21	3 1/4	3.100	3 1/2	21
2 9/16	3 1/4	2.879	3 1/2	26	3 3/8	3.225	3 1/2	24
2 5/8	3 1/4	2.879	3 1/2	20	3 3/8	3.225	3 1/2	19
2 11/16	3 3/8	3.004	3 1/2	25	3 1/2	3.317	3	20
2 3/4	3 3/8	3.004	3 1/2	19	3 7/8	3.442	3	23
2 13/16	3 1/2	3.100	3 1/2	22	3 7/8	3.442	3	18
2 7/8	3 5/8	3.225	3 1/2	26	4	3.567	3	21
2 15/16	3 5/8	3.225	3 1/2	21	4 1/8	3.692	3	24
3	3 3/4	3.317	3	22	4 1/8	3.692	3	19
3 1/8	3 7/8	3.442	3	21	4 3/8	3.923	2 7/8	24
3 1/2	4	3.567	3	20	4 1/2	4.028	2 3/4	21
3 5/8	4 1/8	3.692	3	20	4 5/8	4.153	2 3/4	19
3 1/2	4 1/2	3.798	2 7/8	18				
3 5/8	4 1/8	4.028	2 3/4	23				
3 3/4	4 5/8	4.153	2 3/4	23				
3 7/8	4 3/4	4.255	2 5/8	21				

REMARKS.—As upsetting reduces the strength of iron, bars having the same diameter at root of thread as that of the bar, invariably break in the screw end, when tested to destruction, without developing the full strength of the bar. It is therefore necessary to make up for this loss in strength by an excess of metal in the upset screw ends over that in the bar.

The screw threads in above table are the Franklin Institute standard.

To make one upset end for 5" length of thread allow 6" length of rod additional.

STANDARD SCREW THREADS, NUTS AND BOLT HEADS.

Recommended by Franklin Institute Dec. 15, 1864. And adopted by Navy Dept. of the U. S. By the R. R. Master Mechanics and Master Car-Builders Associations. By Messrs. Jones & Laughlins, Limited, and by many other of the prominent engineering and mechanical establishments of the country.

Angle of thread 60° Flat at top and bottom ⅛ of pitch.

Diam. of Screw.	Threads per inch.	Diam. at root of Thread.	Diam. of Screw.	Threads per inch.	Diam. at root of Thread.
¼	20	.185	2	4½	1.712
5/16	18	.240	2¼	4½	1.962
⅜	16	.294	2½	4	2.176
7/16	14	.344	2¾	4	2.426
½	13	.400	3	3½	2.629
9/16	12	.454	3¼	3½	2.879
⅝	11	.507	3½	3½	3.100
¾	10	.620	3¾	3	3.317
⅞	9	.731	4	3	3.567
1	8	.837	4¼	2⅞	3.798
1⅛	7	.940	4½	2¾	4.028
1¼	7	1.065	4¾	2¾	4.256
1⅜	6	1.160	5	2½	4.480
1½	6	1.284	5¼	2½	4.730
1⅝	5½	1.389	5½	2⅜	4.953
1¾	5	1.491	5¾	2⅜	5.203
1⅞	5	1.616	6	2¼	5.423

Nuts and **Bolt Heads** are determined by the following rules, which apply to Square and Hexagon Nuts both :

Short diameter of rough nut = 1½ × diam. of bolt + ⅛ in.
Short diameter of finished nut = 1⅛ × diam. of bolt + 1/16 in.
Thickness of rough nut = diam. of bolt.
Thickness of finished nut = diam. of bolt − 1/16 in.
Short diameter of rough head = 1½ × diam. of bolt + ⅛ in.
Short diameter of finished head = 1⅛ × diam. of bolt + 1/16 in.
Thickness of rough head = ½ short diam. of head.
Thickness of finished head = diam. of bolt − 1/16 in.

The long diameter of a hexagon nut may be obtained by multiplying the short diameter by 1.155, and the long diameter of a square nut by multiplying the short diameter by 1 414.

SHEET IRON AND STEEL.

WEIGHT OF SUPERFICIAL FOOT, BIRMINGHAM GAUGE.

Gauge.	Weight in Lbs.		Gauge.	Weight in Lbs	
	Iron.	Steel.		Iron.	Steel.
No. 1=.3	12.12	12.36	No. 16=.065	2.63	2.68
" 2=.284	11.48	11.71	" 17=.058	2.34	2.39
" 3=.259	10.47	10.68	" 18=.049	1.98	2.02
" 4=.238	9.62	9.81	" 19=.042	1.70	1.73
" 5=.22	8.89	9.07	" 20=.035	1.56	1.59
" 6=.203	8.20	8.36	" 21=.032	1.40	1.43
" 7=.18	7.27	7.42	" 22=.028	1.25	1.28
" 8=.165	6.67	6.80	" 23=.025	1.12	1.14
" 9=.148	5.98	6.10	" 24=.022	1.	1.02
" 10=.134	5.42	5.53	" 25=.02	.9	.92
" 11=.12	4.85	4.95	" 26=.018	.8	.82
" 12=.109	4.41	4.50	" 27=.016	.72	.73
" 13=.095	3.84	3.92	" 28=.014	.64	.65
" 14=.083	3.35	3.42	" 29=.013	.56	.57
" 15=.072	2.91	2.97	" 30=.012	.5	.51

TANK IRON AND STEEL.

WEIGHT OF SUPERFICIAL FOOT.

Thickness in Inches.	Weight in Lbs.		Thickness in Inches.	Weight in Lbs.	
	Iron.	Steel.		Iron.	Steel.
1/32=.03125	1.27	1.30	5/16= .3125	12.63	12.88
1/16=.0625	2.52	2.57	3/8 = .375	15.16	15.46
3/32=.09375	3.79	3.87	7/16= .4375	17.68	18.03
1/8=.125	5.05	5.15	1/2 = .5	20.21	20.61
5/32=.15625	6.32	6.45	9/16= .5625	22.73	23.19
3/16=.1875	7.58	7.73	5/8 = .625	25.26	25.77
7/32=.21875	8.84	9.02	3/4 = .75	30.31	30.92
1/4 =.25	10.10	10.30	7/8 = .875	35.37	36.08
9/32=.28123	11.38	11.61	1 =1.	40.42	41.23

The low temperature (as compared with Iron) at which Steel Plates have to be finished, causes a slight springing of the rolls, leaving the plate thicker in the center. This, combined with greater density, causes Steel Plates, if kept up to full thickness on the edges, to weigh more than Iron. Both Iron and Steel over 72 inches wide are liable to run even heavier than the weights given above.

WEIGHT OF A CUBIC FOOT OF SUBSTANCES.

NAMES OF SUBSTANCES.	Average Weight. Lbs.
Aluminum	162
Anthracite, solid, of Pennsylvania	93
" broken, loose	54
" " moderately shaken	58
" heaped, bushel, loose	(80)
Ash, American white, dry	38
Asphaltum	87
Brass, (Copper and Zinc,) cast	504
" rolled	524
Brick, best pressed	150
" common hard	125
" soft, inferior	100
Brickwork, pressed brick	140
" ordinary	112
Cement, hydraulic, ground, loose, American, Rosendale	56
" " " " " Louisville	50
" " " " English, Portland	90
Cherry, dry	42
Chestnut, dry	41
Clay, potters', dry	119
" in lump, loose	63
Coal, bituminous, solid	84
" " broken, loose	49
" " heaped bushel, loose	(74)
Coke, loose, of good coal	26
" " heaped bushel	(40)
Copper, cast	542
" rolled	548
Earth, common loam, dry, loose	76
" " " " moderately rammed	95
" as a soft flowing mud	108
Ebony, dry	76
Elm, dry	35
Flint	162

WEIGHT OF SUBSTANCES—CONTINUED.

NAMES OF SUBSTANCES.	Average Weight. Lbs.
Glass, common window	157
Gneiss, common	168
Gold, cast, pure, or 24 carat	1204
" pure, hammered	1217
Granite	170
Gravel, about the same as sand which see.	
Gypsum, (plaster of paris)	142
Hemlock, dry	25
Hickory, dry	53
Hornblende, black	203
Ice	58.7
Iron, cast	450
" wrought, purest	485
" " average	480
Ivory	114
Lead	711
Lignum Vitæ, dry	83
Lime, quick, ground, loose, or in small lumps	53
" " " " thoroughly shaken	75
" " " " per struck bushel	(66)
Limestones and Marbles	168
" " loose, in irregular fragments.	96
Magnesium	109
Mahogany, Spanish, dry	53
" Honduras, dry	35
Maple, dry	49
Marbles, see Limestones.	
Masonry, of granite or limestone, well dressed	165
" " mortar rubble	154
" " dry " (well scabbled)	138
" " sandstone, well dressed	144
Mercury, 32° Fahrenheit	849
Mica	183
Mortar, hardened	103
Mud, dry, close	80 to 110

WEIGHT OF SUBSTANCES—CONTINUED.

NAMES OF SUBSTANCES.	Average Weight. Lbs.
Mud, wet, fluid, maximum	120
Oak, live, dry	59
" white, dry	50
" other kinds	32 to 45
Petroleum	55
Pine, white, dry	25
" yellow, Northern	34
" " Southern	45
Platinum	1342
Quartz, common, pure	165
Rosin	69
Salt, coarse, Syracuse, N. Y.	45
" Liverpool, fine, for table use	49
Sand, of pure quartz, dry, loose	90 to 106
" well shaken	99 to 117
" perfectly wet	120 to 140
Sandstones, fit for building	151
Shales, red or black	162
Silver	655
Slate	175
Snow, freshly fallen	5 to 12
" moistened and compacted by rain	15 to 50
Spruce, dry	25
Steel	490
Sulphur	125
Sycamore, dry	37
Tar	62
Tin, cast	459
Turf or Peat, dry, unpressed	20 to 30
Walnut, black, dry	38
Water, pure rain or distilled, at 60° Fahrenheit	62¼
" sea	64
Wax, bees	60.5
Zinc or Spelter	437.5

Green timbers usually weigh from one-fifth to one-half more than dry.

AREAS AND CIRCUMFERENCES OF CIRCLES.

For Diameters from $\frac{1}{10}$ to 100, advancing by Tenths.

Diam.	Area.	Circum.	Diam.	Area.	Circum.
0.0			4.0	12.5664	12.5664
.1	.007854	.31416	.1	13.2025	12.8805
.2	.031416	.62832	.2	13.8544	13.1947
.3	.070686	.94248	.3	14.5220	13.5088
.4	.12566	1.2566	.4	15.2053	13.8230
.5	.19635	1.5708	.5	15.9043	14.1372
.6	.28274	1.8850	.6	16.6190	14.4513
.7	.38485	2.1991	.7	17.3494	14.7655
.8	.50266	2.5133	.8	18.0956	15.0796
.9	.63617	2.8274	.9	18.8574	15.3938
1.0	.7854	3.1416	5.0	19.6350	15.7080
.1	.9503	3.4558	.1	20.4282	16.0221
.2	1.1310	3.7699	.2	21.2372	16.3363
.3	1.3273	4.0841	.3	22.0618	16.6504
.4	1.5394	4.3982	.4	22.9022	16.9646
.5	1.7671	4.7124	.5	23.7583	17.2788
.6	2.0106	5.0265	.6	24.6301	17.5929
.7	2.2698	5.3407	.7	25.5176	17.9071
.8	2.5447	5.6549	.8	26.4208	18.2212
.9	2.8353	5.9690	.9	27.3397	18.5354
2.0	3.1416	6.2832	6.0	28.2743	18.8496
.1	3.4636	6.5973	.1	29.2247	19.1637
.2	3.8013	6.9115	.2	30.1907	19.4779
.3	4.1548	7.2257	.3	31.1725	19.7920
.4	4.5239	7.5398	.4	32.1699	20.1062
.5	4.9087	7.8540	.5	33.1831	20.4204
.6	5.3093	8.1681	.6	34.2119	20.7345
.7	5.7256	8.4823	.7	35.2565	21.0487
.8	6.1575	8.7965	.8	36.3168	21.3628
.9	6.6052	9.1106	.9	37.3928	21.6770
3.0	7.0686	9.4248	7.0	38.4845	21.9911
.1	7.5477	9.7389	.1	39.5919	22.3053
.2	8.0425	10.0531	.2	40.7150	22.6195
.3	8.5530	10.3673	.3	41.8539	22.9336
.4	9.0792	10.6814	.4	43.0084	23.2478
.5	9.6211	10.9956	.5	44.1786	23.5619
.6	10.1788	11.3097	.6	45.3646	23.8761
.7	10.7521	11.6239	.7	46.5663	24.1903
.8	11.3411	11.9381	.8	47.7836	24.5044
.9	11.9459	12.2522	.9	49.0167	24.8186

AREAS AND CIRCUMFERENCES OF CIRCLES.

(CONTINUED.)

Diam.	Area.	Circum.	Diam.	Area.	Circum.
8.0	50.2655	25.1327	12.0	113.0973	37.6991
.1	51.5300	25.4469	.1	114.9901	38.0133
.2	52.8102	25.7611	.2	116.8987	38.3274
.3	54.1061	26.0752	.3	118.8229	38.6416
.4	55.4177	26.3894	.4	120.7628	38.9557
.5	56.7450	26.7035	.5	122.7185	39.2699
.6	58.0880	27.0177	.6	124 6898	39.5841
.7	59.4468	27.3319	.7	126.6769	39.8982
.8	60.8212	27.6460	.8	128.6796	40.2124
.9	62.2114	27.9602	.9	130.6981	40.5265
9.0	63.6173	28.2743	13.0	132.7323	40.8407
.1	65.0388	28.5885	.1	134.7822	41.1549
.2	66.4761	28.9027	.2	136.8478	41.4690
.3	67.9291	29.2168	.3	138.9291	41.7832
.4	69.3978	29.5310	.4	141.0261	42.0973
.5	70.8822	29.8451	.5	143.1388	42.4115
.6	72.3823	30.1593	.6	145.2672	42.7257
.7	73.8981	30.4734	.7	147.4114	43.0398
.8	75.4296	30.7876	.8	149.5712	43.3540
.9	76.9769	31.1018	.9	151.7468	43.6681
10.0	78.5398	31.4159	14.0	153.9380	43.9823
.1	80.1185	31.7301	.1	156.1450	44.2965
.2	81.7128	32.0442	.2	158.3677	44.6106
.3	83.3229	32.3584	.3	160.6061	44.9248
.4	84.9487	32.6726	.4	162.8602	45.2389
.5	86.5901	32.9867	.5	165.1300	45.5531
.6	88.2473	33.3009	.6	167.4155	45.8673
.7	89.9202	33.6150	.7	169.7167	46.1814
.8	91.6088	33.9292	.8	172.0336	46.4956
.9	93.3132	34.2434	.9	174.3662	46.8097
11.0	95.0332	34.5575	15.0	176.7146	47.1239
.1	96.7689	34.8717	.1	179.0786	47.4380
.2	98.5203	35.1858	.2	181.4584	47.7522
.3	100.2875	35.5000	.3	183.8539	48.0664
.4	102.0703	35.8142	.4	186.2650	48.3805
.5	103.8689	36.1283	.5	188.6919	48.6947
.6	105.6832	36.4425	.6	191.1345	49.0088
.7	107.5132	36.7566	.7	193.5928	49.3230
.8	109.3588	37.0708	.8	196.0668	49.6372
.9	111.2202	37.3850	.9	198.5565	49.9513

AREAS AND CIRCUMFERENCES OF CIRCLES.

(CONTINUED.)

Diam.	Area.	Circum.	Diam.	Area.	Circum.
16.0	201.0619	50.2655	20.0	314.1593	62.8319
.1	203.5831	50.5796	.1	317.3087	63.1460
.2	206.1199	50.8938	.2	320.4739	63.4602
.3	208.6724	51.2080	.3	323.6547	63.7743
.4	211.2407	51.5221	.4	326.8513	64.0885
.5	213.8246	51.8363	.5	330.0636	64.4026
.6	216.4243	52.1504	.6	333.2916	64.7168
.7	219.0397	52.4646	.7	336.5353	65.0310
.8	221.6708	52.7788	.8	339.7947	65.3451
.9	224.3176	53.0929	.9	343.0698	65.6593
17.0	226.9801	53.4071	21.0	346.3606	65.9734
.1	229.6583	53.7212	.1	349.6671	66.2876
.2	232.3522	54.0354	.2	352.9894	66.6018
.3	235.0618	54.3496	.3	356.3273	66.9159
.4	237.7871	54.6637	.4	359.6809	67.2301
.5	240.5282	54.9779	.5	363.0503	67.5442
.6	243.2849	55.2920	.6	366.4354	67.8584
.7	246.0574	55.6062	.7	369.8361	68.1726
.8	248.8456	55.9203	.8	373.2526	68.4867
.9	251.6494	56.2345	.9	376.6848	68.8009
18.0	254.4690	56.5486	22.0	380.1327	69.1150
.1	257.3043	56.8628	.1	383.5963	69.4292
.2	260.1553	57.1770	.2	387.0756	69.7434
.3	263.0220	57.4911	.3	390.5707	70.0575
.4	265.9044	57.8053	.4	394.0814	70.3717
.5	268.8025	58.1195	.5	397.6078	70.6858
.6	271.7164	58.4336	.6	401.1500	71.0000
.7	274.6459	58.7478	.7	404.7078	71.3142
.8	277.5911	59.0619	.8	408.2814	71.6283
.9	280.5521	59.3761	.9	411.8707	71.9425
19.0	283.5287	59.6903	23.0	415.4756	72.2566
.1	286.5211	60.0044	.1	419.0963	72.5708
.2	289.5292	60.3186	.2	422.7327	72.8849
.3	292.5530	60.6327	.3	426.3848	73.1991
.4	295.5925	60.9469	.4	430.0526	73.5133
.5	298.6477	61.2611	.5	433.7361	73.8274
.6	301.7186	61.5752	.6	437.4354	74.1416
.7	304.8052	61.8894	.7	441.1503	74.4557
.8	307.9075	62.2035	.8	444.8809	74.7699
.9	311.0255	62.5177	.9	448.6273	75.0841

AREAS AND CIRCUMFERENCES OF CIRCLES.

(CONTINUED.)

Diam.	Area.	Circum.	Diam.	Area.	Circum.
24.0	452.3893	75.3982	28.0	615.7522	87.9646
.1	456.1671	75.7124	.1	620.1582	88.2788
.2	459.9606	76.0265	.2	624.5800	88.5929
.3	463.7698	76.3407	.3	629.0175	88.9071
.4	467.5947	76.6549	.4	633.4707	89.2212
.5	471.4352	76.9690	.5	637.9397	89.5354
.6	475.2916	77.2832	.6	642.4243	89.8495
.7	479.1636	77.5973	.7	646.9246	90.1637
.8	483.0513	77.9115	.8	651.4407	90.4779
.9	486.9547	78.2257	.9	655.9724	90.7920
25.0	490.8739	78.5398	29.0	660.5199	91.1062
.1	494.8087	78.8540	.1	665.0830	91.4203
.2	498.7592	79.1681	.2	669.6619	91.7345
.3	502.7255	79.4823	.3	674.2565	92.0487
.4	506.7075	79.7965	.4	678.8668	92.3628
.5	510.7052	80.1106	.5	683.4928	92.6770
.6	514.7185	80.4248	.6	688.1345	92.9911
.7	518.7476	80.7389	.7	692.7919	93.3053
.8	522.7924	81.0531	.8	697.4650	93.6195
.9	526.8529	81.3672	.9	702.1538	93.9336
26.0	530.9292	81.6814	30.0	706.8583	94.2478
.1	535.0211	81.9956	.1	711.5786	94.5619
.2	539.1287	82.3097	.2	716.3145	94.8761
.3	543.2521	82.6239	.3	721.0662	95.1903
.4	547.3911	82.9380	.4	725.8336	95.5044
.5	551.5459	83.2522	.5	730.6167	95.8186
.6	555.7163	83.5664	.6	735.4154	96.1327
.7	559.9025	83.8805	.7	740.2299	96.4469
.8	564.1044	84.1947	.8	745.0601	96.7611
.9	568.3220	84.5088	.9	749.9060	97.0752
27.0	572.5553	84.8230	31.0	754.7676	97.3894
.1	576.8043	85.1372	.1	759.6450	97.7035
.2	581.0690	85.4513	.2	764.5380	98.0177
.3	585.3494	85.7655	.3	769.4467	98.3319
.4	589.6455	86.0796	.4	774.3712	98.6460
.5	593.9574	86.3938	.5	779.3113	98.9602
.6	598.2849	86.7080	.6	784.2672	99.2743
.7	602.6282	87.0221	.7	789.2388	99.5885
.8	606.9871	87.3363	.8	794.2260	99.9026
.9	611.3618	87.6504	.9	799.2290	100.2168

AREAS AND CIRCUMFERENCES OF CIRCLES,

(CONTINUED.)

Diam.	Area.	Circum.	Diam.	Area.	Circum.
32.0	804.2477	100.5310	36.0	1017.8760	113.0973
.1	809.2821	100.8451	.1	1023.5887	113.4115
.2	814.3322	101.1593	.2	1029.2172	113.7257
.3	819.3980	101.4734	.3	1034.9113	114.0398
.4	824.4796	101.7876	.4	1040.6212	114.3540
.5	829.5768	102.1018	.5	1046.3467	114.6681
.6	834.6898	102.4159	.6	1052.0880	114.9823
.7	839.8185	102.7301	.7	1057.8449	115.2965
.8	844.9628	103.0442	.8	1063.6176	115.6106
.9	850.1229	103.3584	.9	1069.4060	115.9248
33.0	855.2986	103.6726	37.0	1075.2101	116.2389
.1	860.4902	103.9867	.1	1081.0299	116.5531
.2	865.6973	104.3009	.2	1086.8654	116.8672
.3	870.9202	104.6150	.3	1092.7166	117.1814
.4	876.1588	104.9292	.4	1098.5835	117.4956
.5	881.4131	105.2434	.5	1104.4662	117.8097
.6	886.6831	105.5575	.6	1110.3645	118.1239
.7	891.9688	105.8717	.7	1116.2786	118.4380
.8	897.2703	106.1858	.8	1122.2083	118.7522
.9	902.5874	106.5000	.9	1128.1538	119.0664
34.0	907.9203	106.8142	38.0	1134.1149	119.3805
.1	913.2688	107.1283	.1	1140.0918	119.6947
.2	918.6331	107.4425	.2	1146.0844	120.0088
.3	924.0131	107.7566	.3	1152.0927	120.3230
.4	929.4088	108.0708	.4	1158.1167	120.6372
.5	934.8202	108.3849	.5	1164.1564	120.9513
.6	940.2473	108.6991	.6	1170.2118	121.2655
.7	945.6901	109.0133	.7	1176.2830	121.5796
.8	951.1486	109.3274	.8	1182.3698	121.8938
.9	956.6228	109.6416	.9	1188.4724	122.2080
35.0	962.1128	109.9557	39.0	1194.5906	122.5221
.1	967.6184	110.2699	.1	1200.7246	122.8363
.2	973.1397	110.5841	.2	1206.8742	123.1504
.3	978.6768	110.8982	.3	1213.0396	123.4646
.4	984.2296	111.2124	.4	1219.2207	123.7788
.5	989.7980	111.5265	.5	1225.4175	124.0929
.6	995.3822	111.8407	.6	1231.6300	124.4071
.7	1000.9821	112.1549	.7	1237.8582	124.7212
.8	1006.5977	112.4690	.8	1244.1021	125.0354
.9	1012.2290	112.7832	.9	1250.3617	125.3495

AREAS AND CIRCUMFERENCES OF CIRCLES.

(CONTINUED.)

Diam.	Area.	Circum.	Diam.	Area.	Circum.
40.0	1256.6371	125.6637	44.0	1520.5308	138.2301
.1	1262.9281	125.9779	.1	1527.4502	138.5442
.2	1269.2348	126.2920	.2	1534.3853	138.8584
.3	1275.5573	126.6062	.3	1541.3360	139.1726
.4	1281.8955	126.9203	.4	1548.3025	139.4867
.5	1288.2493	127.2345	.5	1555.2847	139.8009
.6	1294.6189	127.5487	.6	1562.2826	140.1153
.7	1301.0042	127.8628	.7	1569.2962	140.4292
.8	1307.4052	128.1770	.8	1576.3255	140.7434
.9	1313.8219	128.4911	.9	1583.3706	141.0575
41.0	1320.2543	128.8053	45.0	1590.4313	141.3717
.1	1326.7024	129.1195	.1	1597.5077	141.6858
.2	1333.1663	129.4336	.2	1604.5999	142.0000
.3	1339.6458	129.7478	.3	1611.7077	142.3142
.4	1346.1410	130.0619	.4	1618.8313	142.6283
.5	1352.6520	130.3761	.5	1625.9705	142.9425
.6	1359.1786	130.6903	.6	1633.1255	143.2566
.7	1365.7210	131.0044	.7	1640.2962	143.5708
.8	1372.2791	131.3186	.8	1647.4826	143.8849
.9	1378.8529	131.6327	.9	1654.6847	144.1991
42.0	1385.4424	131.9469	46.0	1661.9025	144.5133
.1	1392.0476	132.2611	.1	1669.1360	144.8274
.2	1398.6685	132.5752	.2	1676.3853	145.1416
.3	1405.3051	132.8894	.3	1683.6502	145.4557
.4	1411.9574	133.2035	.4	1690.9308	145.7699
.5	1418.6254	133.5177	.5	1698.2272	146.0841
.6	1425.3092	133.8318	.6	1705.5392	146.3982
.7	1432.0086	134.1460	.7	1712.8670	146.7124
.8	1438.7238	134.4602	.8	1720.2105	147.0265
.9	1445.4546	134.7743	.9	1727.5697	147.3407
43.0	1452.2012	135.0885	47.0	1734.9445	147.6550
.1	1458.9635	135.4026	.1	1742.3351	147.9690
.2	1465.7415	135.7168	.2	1749.7414	148.2832
.3	1472.5352	136.0310	.3	1757.1635	148.5973
.4	1479.3446	136.3451	.4	1764.6012	148.9115
.5	1486.1697	136.6593	.5	1772.0546	149.2257
.6	1493.0105	136.9734	.6	1779.5237	149.5398
.7	1499.8670	137.2876	.7	1787.0086	149.8540
.8	1506.7393	137.6018	.8	1794.5091	150.1681
.9	1513.6272	137.9159	.9	1802.0254	150.4823

AREAS AND CIRCUMFERENCES OF CIRCLES.

(CONTINUED.)

Diam.	Area.	Circum.	Diam.	Area.	Circum.
48.0	1809.5574	150.7964	52.0	2123.7166	163.3628
.1	1817.1050	151.1106	.1	2131.8926	163.6770
.2	1824.6684	151.4248	.2	2140.0843	163.9911
.3	1832.2475	151.7389	.3	2148.2917	164.3053
.4	1839.8423	152.0531	.4	2156.5149	164.6195
.5	1847.4528	152.3672	.5	2164.7537	164.9336
.6	1855.0790	152.6814	.6	2173.0082	165.2479
.7	1862.7210	152.9956	.7	2181.2785	165.5619
.8	1870.3786	153.3097	.8	2189.5644	165.8761
.9	1878.0519	153.6239	.9	2197.8661	166.1903
49.0	1885.7409	153.9380	53.0	2206.1834	166.5044
.1	1893.4457	154.2522	.1	2214.5165	166.8186
.2	1901.1662	154.5664	.2	2222.8653	167.1327
.3	1908.9024	154.8805	.3	2231.2298	167.4469
.4	1916.6543	155.1947	.4	2239.6100	167.7610
.5	1924.4218	155.5088	.5	2248.0059	168.0752
.6	1932.2051	155.8230	.6	2256.4175	168.3894
.7	1940.0042	156.1372	.7	2264.8448	168.7035
.8	1947.8189	156.4513	.8	2273.2879	169.0177
.9	1955.6493	156.7655	.9	2281.7466	169.3318
50.0	1963.4954	157.0796	54.0	2290.2210	169.6460
.1	1971.3572	157.3938	.1	2298.7112	169.9602
.2	1979.2348	157.7080	.2	2307.2171	170.2743
.3	1987.1280	158.0221	.3	2315.7386	170.5885
.4	1995.0370	158.3363	.4	2324.2759	170.9026
.5	2002.9617	158.6504	.5	2332.8289	171.2168
.6	2010.9020	158.9646	.6	2341.3976	171.5310
.7	2018.8581	159.2787	.7	2349.9820	171.8451
.8	2026.8299	159.5929	.8	2358.5821	172.1593
.9	2034.8174	159.9071	.9	2367.1979	172.4735
51.0	2042.8206	160.2212	55.0	2375.8294	172.7876
.1	2050.8395	160.5354	.1	2384.4767	173.1017
.2	2058.8742	160.8495	.2	2393.1396	173.4159
.3	2066.9245	161.1637	.3	2401.8183	173.7301
.4	2074.9905	161.4779	.4	2410.5126	174.0442
.5	2083.0723	161.7920	.5	2419.2227	174.3584
.6	2091.1697	162.1062	.6	2427.9485	174.6726
.7	2099.2829	162.4203	.7	2436.6899	174.9867
.8	2107.4118	162.7345	.8	2445.4471	175.3009
.9	2115.5563	163.0487	.9	2454.2200	175.6150

AREAS AND CIRCUMFERENCES OF CIRCLES.

(CONTINUED.)

Diam.	Area.	Circum.	Diam.	Area.	Circum.
56.0	2463.0086	175.9292	60.0	2827.4334	188.4956
.1	2471.8130	176.2433	.1	2836.8660	188.8097
.2	2480.6330	176.5575	.2	2846.3144	189.1239
.3	2489.4687	176.8717	.3	2855.7784	189.4380
.4	2498.3201	177.1858	.4	2865.2582	189.7522
.5	2507.1873	177.5000	.5	2874.7536	190.0664
.6	2516.0701	177.8141	.6	2884.2648	190.3805
.7	2524.9687	178.1283	.7	2893.7917	190.6947
.8	2533.8830	178.4425	.8	2903.3343	191.0088
.9	2542.8129	178.7566	.9	2912.8926	191.3230
57.0	2551.7586	179.0708	61.0	2922.4666	191.6372
.1	2560.7200	179.3849	.1	2932.0563	191.9513
.2	2569.6971	179.6991	.2	2941.6617	192.2655
.3	2578.6899	180.0133	.3	2951.2828	192.5796
.4	2587.6985	180.3274	.4	2960.9197	192.8938
.5	2596.7227	180.6416	.5	2970.5722	193.2079
.6	2605.7626	180.9557	.6	2980.2405	193.5221
.7	2614.8183	181.2699	.7	2989.9244	193.8363
.8	2623.8896	181.5841	.8	2999.6241	194.1504
.9	2632.9767	181.8982	.9	3009.3395	194.4646
58.0	2642.0794	182.2124	62.0	3019.0705	194.7787
.1	2651.1979	182.5265	.1	3028.8173	195.0929
.2	2660.3321	182.8407	.2	3038.5798	195.4071
.3	2669.4820	183.1549	.3	3048.3580	195.7212
.4	2678.6476	183.4690	.4	3058.1520	196.0354
.5	2687.8289	183.7832	.5	3067.9616	196.3495
.6	2697.0259	184.0973	.6	3077.7869	196.6637
.7	2706.2386	184.4115	.7	3087.6279	196.9779
.8	2715.4670	184.7256	.8	3097.4847	197.2920
.9	2724.7112	185.0398	.9	3107.3571	197.6062
59.0	2733.9710	185.3540	63.0	3117.2453	197.9203
.1	2743.2466	185.6681	.1	3127.1492	198.2345
.2	2752.5378	185.9823	.2	3137.0688	198.5487
.3	2761.8448	186.2964	.3	3147.0040	198.8628
.4	2771.1675	186.6106	.4	3156.9550	199.1770
.5	2780.5058	186.9248	.5	3166.9217	199.4911
.6	2789.8599	187.2389	.6	3176.9043	199.8053
.7	2799.2297	187.5531	.7	3186.9023	200.1195
.8	2808.6152	187.8672	.8	3196.9161	200.4336
.9	2818.0165	188.1814	.9	3206.9456	200.7478

AREAS AND CIRCUMFERENCES OF CIRCLES.

(CONTINUED.)

Diam.	Area.	Circum.	Diam.	Area.	Circum.
64.0	3216.9909	201.0620	68.0	3631.6811	213.6283
.1	3227.0518	201.3761	.1	3642.3704	213.9425
.2	3237.1285	201.6902	.2	3653.0754	214.2566
.3	3247.2222	202.0044	.3	3663.7960	214.5708
.4	3257.3289	202.3186	.4	3674.5324	214.8849
.5	3267.4527	202.6327	.5	3685.2845	215.1991
.6	3277.5922	202.9469	.6	3696.0523	215.5133
.7	3287.7474	203.2610	.7	3706.8359	215.8274
.8	3297.9183	203.5752	.8	3717.6351	216.1416
.9	3308.1049	203.8894	.9	3728.4500	216.4556
65.0	3318.3072	204.2035	69.0	3739.2807	216.7699
.1	3328.5253	204.5176	.1	3750.1270	217.0841
.2	3338.7590	204.8318	.2	3760.9891	217.3982
.3	3349.0085	205.1460	.3	3771.8668	217.7124
.4	3359.2736	205.4602	.4	3782.7603	218.0265
.5	3369.5545	205.7743	.5	3793.6695	218.3407
.6	3379.8510	206.0885	.6	3804.5944	218.6548
.7	3390.1633	206.4026	.7	3815.5350	218.9690
.8	3400.4913	206.7168	.8	3826.4913	219.2832
.9	3410.8350	207.0310	.9	3837.4633	219.5973
66.0	3421.1944	207.3451	70.0	3848.4510	219.9115
.1	3431.5695	207.6593	.1	3859.4544	220.2256
.2	3441.9603	207.9734	.2	3870.4736	220.5398
.3	3452.3669	208.2876	.3	3881.5084	220.8540
.4	3462.7891	208.6017	.4	3892.5590	221.1681
.5	3473.2270	208.9159	.5	3903.6252	221.4823
.6	3483.6807	209.2301	.6	3914.7072	221.7964
.7	3494.1500	209.5442	.7	3925.8049	222.1106
.8	3504.6351	209.8584	.8	3936.9182	222.4248
.9	3515.1359	210.1725	.9	3948.0473	222.7389
67.0	3525.6524	210.4867	71.0	3959.1921	223.0531
.1	3536.1845	210.8009	.1	3970.3526	223.3672
.2	3546.7324	211.1150	.2	3981.5289	223.6814
.3	3557.2960	211.4292	.3	3992.7208	223.9956
.4	3567.8754	211.7433	.4	4003.9284	224.3097
.5	3578.4704	212.0575	.5	4015.1518	224.6239
.6	3589.0811	212.3717	.6	4026.3908	224.9380
.7	3599.7075	212.6858	.7	4037.6456	225.2522
.8	3610.3497	213.0000	.8	4048.9160	225.5664
.9	3621.0075	213.3141	.9	4060.2022	225.8805

AREAS AND CIRCUMFERENCES OF CIRCLES.

(CONTINUED.)

Diam.	Area.	Circum.	Diam.	Area.	Circum.
72.0	4071.5041	226.1947	76.0	4536.4598	238.7610
.1	4082.8217	226.5088	.1	4548.4057	239.0752
.2	4094.1550	226.8230	.2	4560.3673	239.3894
.3	4105.5040	227.1371	.3	4572.3446	239.7035
.4	4116.8687	227.4513	.4	4584.3377	240.0177
.5	4128.2491	227.7655	.5	4596.3464	240.3318
.6	4139.6452	228.0796	.6	4608.3708	240.6460
.7	4151.0571	228.3938	.7	4620.4110	240.9602
.8	4162.4846	228.7079	.8	4632.4669	241.2743
.9	4173.9279	229.0221	.9	4644.5384	241.5885
73.0	4185.3868	229.3363	77.0	4656.6257	241.9026
.1	4196.8615	229.6504	.1	4668.7287	242.2168
.2	4208.3519	229.9646	.2	4680.8474	242.5310
.3	4219.8579	230.2787	.3	4692.9818	242.8451
.4	4231.3797	230.5929	.4	4705.1319	243.1592
.5	4242.9172	230.9071	.5	4717.2977	243.4734
.6	4254.4704	231.2212	.6	4729.4792	243.7876
.7	4266.0394	231.5354	.7	4741.6765	244.1017
.8	4277.6240	231.8495	.8	4753.8894	244.4159
.9	4289.2243	232.1637	.9	4766.1181	244.7301
74.0	4300.8403	232.4779	78.0	4778.3624	245.0442
.1	4312.4721	232.7920	.1	4790.6225	245.3584
.2	4324.1195	233.1062	.2	4802.8983	245.6725
.3	4335.7827	233.4203	.3	4815.1897	245.9867
.4	4347.4616	233.7345	.4	4827.4969	246.3009
.5	4359.1562	234.0487	.5	4839.8198	246.6150
.6	4370.8664	234.3628	.6	4852.1584	246.9292
.7	4382.5924	234.6770	.7	4864.5128	247.2433
.8	4394.3341	234.9911	.8	4876.8828	247.5575
.9	4406.0916	235.3053	.9	4889.2685	247.8717
75.0	4417.8647	235.6194	79.0	4901.6699	248.1858
.1	4429.6535	235.9336	.1	4914.0871	248.5000
.2	4441.4580	236.2478	.2	4926.5199	248.8141
.3	4453.2783	236.5619	.3	4938.9685	249.1283
.4	4465.1142	236.8761	.4	4951.4328	249.4425
.5	4476.9659	237.1902	.5	4963.9127	249.7566
.6	4488.8332	237.5044	.6	4976.4084	250.0708
.7	4500.7163	237.8186	.7	4988.9198	250.3850
.8	4512.6151	238.1327	.8	5001.4469	250.6991
.9	4524.5296	238.4469	.9	5013.9897	251.0133

AREAS AND CIRCUMFERENCES OF CIRCLES.

(CONTINUED.)

Diam.	Area.	Circum.	Diam.	Area.	Circum.
80.0	5026.5482	251.3274	84.0	5541.7694	263.8938
.1	5039.1225	251.6416	.1	5554.9720	264.2079
.2	5051.7124	251.9557	.2	5568.1902	264.5221
.3	5064.3180	252.2699	.3	5581.4242	264.8363
.4	5076.9394	252.5840	.4	5594.6739	265.1514
.5	5089.5764	252.8982	.5	5607.9392	265.4646
.6	5102.2292	253.2124	.6	5621.2203	265.7787
.7	5114.8977	253.5265	.7	5634.5171	266.0929
.8	5127.5819	253.8407	.8	5647.8296	266.4071
.9	5140.2818	254.1548	.9	5661.1578	266.7212
81.0	5152.9973	254.4690	85.0	5674.5017	267.0354
.1	5165.7287	254.7832	.1	5687.8614	267.3495
.2	5178.4757	255.0973	.2	5701.2367	267.6637
.3	5191.2384	255.4115	.3	5714.6277	267.9779
.4	5204.0168	255.7256	.4	5728.0345	268.2920
.5	5216.8110	256.0398	.5	5741.4569	268.6062
.6	5229.6208	256.3540	.6	5754.8951	268.9203
.7	5242.4463	256.6681	.7	5768.3490	269.2345
.8	5255.2876	256.9823	.8	5781.8185	269.5486
.9	5268.1446	257.2966	.9	5795.3038	269.8628
82.0	5281.0173	257.6106	86.0	5808.8048	270.1770
.1	5293.9056	257.9247	.1	5822.3215	270.4911
.2	5306.8097	258.2389	.2	5835.8539	270.8053
.3	5319.7295	258.5531	.3	5849.4020	271.1194
.4	5332.6650	258.8672	.4	5862.9659	271.4336
.5	5345.6162	259.1814	.5	5876.5454	271.7478
.6	5358.5832	259.4956	.6	5890.1407	272.0619
.7	5371.5658	259.8097	.7	5903.7516	272.3761
.8	5384.5641	260.1239	.8	5917.3783	272.6902
.9	5397.5782	260.4380	.9	5931.0206	273.0044
83.0	5410.6079	260.7522	87.0	5944.6787	273.3186
.1	5423.6534	261.0663	.1	5958.3525	273.6327
.2	5436.7146	261.3805	.2	5972.0420	273.9469
.3	5449.7915	261.6947	.3	5985.7472	274.2610
.4	5462.8840	262.0088	.4	5999.4681	274.5752
.5	5475.9923	262.3230	.5	6013.2047	274.8894
.6	5489.1163	262.6371	.6	6026.9570	275.2035
.7	5502.2561	262.9513	.7	6040.7250	275.5177
.8	5515.4115	263.2655	.8	6054.5088	275.8318
.9	5528.5826	263.5796	.9	6068.3082	276.1460

AREAS AND CIRCUMFERENCES OF CIRCLES.

(CONTINUED.)

Diam.	Area.	Circum.	Diam.	Area.	Circum.
88.0	6082.1284	276.4602	92.0	6647.6101	289.0265
.1	6095.9542	276.7743	.1	6662.0692	289.3407
.2	6109.8008	277.0885	.2	6676.5441	289.6548
.3	6123.6681	277.4026	.3	6691.0347	289.9690
.4	6137.5411	277.7168	.4	6705.5410	290.2832
.5	6151.4348	278.0309	.5	6720.0630	290.5973
.6	6165.3442	278.3451	.6	6734.6008	290.9115
.7	6179.2693	278.6593	.7	6749.1542	291.2256
.8	6193.2101	278.9740	.8	6763.7233	291.5398
.9	6207.1666	279.2876	.9	6778.3082	291.8540
89.0	6221.1389	279.6017	93.0	6792.9087	292.1681
.1	6235.1268	279.9159	.1	6807.5250	292.4823
.2	6249.1304	280.2301	.2	6822.1569	292.7964
.3	6263.1498	280.5442	.3	6836.8046	293.1106
.4	6277.1849	280.8584	.4	6851.4680	293.4248
.5	6291.2356	281.1725	.5	6866.1471	293.7389
.6	6305.3021	281.4867	.6	6880.8419	294.0531
.7	6319.3843	281.8009	.7	6895.5524	294.3672
.8	6333.4822	282.1150	.8	6910.2786	294.6814
.9	6347.5958	282.4292	.9	6925.0205	294.9956
90.0	6361.7251	282.7433	94.0	6939.7782	295.3097
.1	6375.8701	283.0575	.1	6954.5515	295.6239
.2	6390.0309	283.3717	.2	6969.3106	295.9380
.3	6404.2073	283.6858	.3	6984.1453	296.2522
.4	6418.3995	284.0000	.4	6998.9658	296.5663
.5	6432.6073	284.3141	.5	7013.8019	296.8805
.6	6446.8309	284.6283	.6	7028.6538	297.1947
.7	6461.0701	284.9425	.7	7043.5214	297.5088
.8	6475.3251	285.2566	.8	7058.4047	297.8230
.9	6489.5958	285.5708	.9	7073.3033	298.1371
91.0	6503.8822	285.8849	95.0	7088.2184	298.4513
.1	6518.1843	286.1991	.1	7103.1488	298.7655
.2	6532.5021	286.5133	.2	7118.1950	299.0796
.3	6546.8356	286.8274	.3	7133.0568	299.3938
.4	6561.1848	287.1416	.4	7148.0343	299.7079
.5	6575.5498	287.4557	.5	7163.0276	300.0221
.6	6589.9304	287.7699	.6	7178.0366	300.3363
.7	6604.3268	288.0840	.7	7193.0612	300.6504
.8	6618.7388	288.3982	.8	7208.1016	300.9646
.9	6633.1666	288.7124	.9	7223.1577	301.2787

AREAS AND CIRCUMFERENCES OF CIRCLES.

(CONTINUED.)

Diam.	Area.	Circum.	Diam.	Area.	Circum.
96.0	7238.2295	301.5929	98.0	7542.9640	307.8761
.1	7253.3170	301.9071	.1	7558.3656	308.1902
.2	7268.4202	302.2212	.2	7573.7830	308.5044
.3	7283.5391	302.5354	.3	7589.2161	308.8186
.4	7298.6737	302.8405	.4	7604.6648	309.1327
.5	7313.8240	303.1637	.5	7620.1293	309.4469
.6	7328.9901	303.4779	.6	7635.6095	309.7610
.7	7344.1718	303.7920	.7	7651.1054	310.0752
.8	7359.3693	304.1062	.8	7666.6170	310.3894
.9	7374.5824	304.4203	.9	7682.1444	310.7035
97.0	7389.8113	304.7345	99.0	7697.6893	311.0177
.1	7405.0559	305.0486	.1	7713.2461	311.3318
.2	7420.3162	305.3628	.2	7728.8206	311.6460
.3	7435.5922	305.6770	.3	7744.4107	311.9602
.4	7450.8839	305.9911	.4	7760.0166	312.2743
.5	7466.1913	306.3053	.5	7775.6382	312.5885
.6	7481.5144	306.6194	.6	7791.2754	312.9026
.7	7496.8532	306.9336	.7	7806.9284	313.2168
.8	7512.2078	307.2478	.8	7822.5971	313.5309
.9	7527.5780	307.5619	.9	7838.2815	313.8451
			100.0	7853.9816	314.1593

To compute the area or circumference of a diameter greater than 100 and less than 1001:

Take out the area or circumference from table as though the number had one decimal, and move the decimal point two places to the right for the area, and one place for the circumference.

EXAMPLE—Wanted the area and circumference of 567. The tabular area for 56.7 is 2524.9687, and circumference 178.1283. Therefore area for 567 = 252496.87 and circumference = 1781.283.

To compute the area or circumference of a diameter greater than 1000:

Divide by a factor, as 2, 3, 4, 5, etc., if practicable, that will leave a quotient to be found in table, then multiply the tabular area of the quotient by the *square* of the factor, or the tabular circumference by the factor.

EXAMPLE—Wanted the area and circumference of 2109. Dividing by 3, the quotient is 703, for which the area is 388150.84, and the circumference 2208.54. Therefore area of 2109 = 388150.84 × 9 = 3493357.56 and circumference = 2208.54 × 3 = 6625.62.

LOGARITHMS OF NUMBERS.

No.	0	1	2	3	4	5	6	7	8	9	Diff.
10	0000	0043	0086	0128	0170	0212	0253	0294	0334	0374	40
11	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755	37
12	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106	33
13	1139	1173	1206	1239	1271	1303	1335	1367	1399	1430	31
14	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732	29
15	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014	27
16	2041	2068	2095	2122	2148	2175	2201	2227	2253	2279	25
17	2304	2330	2355	2380	2405	2430	2455	2480	2504	2529	24
18	2553	2577	2601	2625	2648	2672	2695	2718	2742	2765	23
19	2788	2810	2833	2856	2878	2900	2923	2945	2967	2989	21
20	3010	3032	3054	3075	3096	3118	3139	3160	3181	3201	21
21	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404	20
22	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598	19
23	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784	18
24	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962	17
25	3979	3997	4014	4031	4048	4065	4082	4099	4116	4133	17
26	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298	16
27	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456	16
28	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609	15
29	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757	14
30	4771	4786	4800	4814	4829	4843	4857	4871	4886	4900	14
31	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038	13
32	5051	5065	5079	5092	5105	5119	5132	5145	5159	5172	13
33	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302	13
34	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428	13
35	5441	5453	5465	5478	5490	5502	5514	5527	5539	5551	12
36	5563	5575	5587	5599	5611	5623	5635	5647	5658	5670	12
37	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786	12
38	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899	12
39	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010	11
No.	0	1	2	3	4	5	6	7	8	9	Diff.

LOGARITHMS OF NUMBERS—CONTINUED.

No.	0	1	2	3	4	5	6	7	8	9	Diff.
40	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117	11
41	6128	6138	6149	6160	6170	6180	6191	6201	6212	6222	10
42	6232	6243	6253	6263	6274	6284	6294	6304	6314	6325	10
43	6335	6345	6355	6365	6375	6385	6395	6405	6415	6425	10
44	6435	6444	6454	6464	6474	6484	6493	6503	6513	6522	10
45	6532	6542	6551	6561	6571	6580	6590	6599	6609	6618	10
46	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712	9
47	6721	6730	6739	6749	6758	6767	6776	6785	6794	6803	9
48	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893	9
49	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981	9
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067	9
51	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152	8
52	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235	8
53	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316	8
54	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396	8
55	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474	8
56	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551	8
57	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627	7
58	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701	8
59	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774	8
60	7782	7789	7796	7803	7810	7818	7825	7832	7839	7846	7
61	7853	7860	7868	7875	7882	7889	7896	7903	7910	7917	7
62	7924	7931	7938	7945	7952	7959	7966	7973	7980	7987	6
63	7993	8000	8007	8014	8021	8028	8035	8041	8048	8055	7
64	8062	8069	8075	8082	8089	8096	8102	8109	8116	8122	7
65	8129	8136	8142	8149	8156	8162	8169	8176	8182	8189	6
66	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254	7
67	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319	6
68	8325	8331	8338	8344	8351	8357	8363	8370	8376	8382	6
69	8388	8395	8401	8407	8414	8420	8426	8432	8439	8445	6
No.	0	1	2	3	4	5	6	7	8	9	Diff.

LOGARITHMS OF NUMBERS—CONTINUED.

No.	0	1	2	3	4	5	6	7	8	9	Dif.
70	8451	8457	8463	8470	8476	8482	8488	8494	8500	8506	7
71	8513	8519	8525	8531	8537	8543	8549	8555	8561	8567	6
72	8573	8579	8585	8591	8597	8603	8609	8615	8621	8627	6
73	8633	8639	8645	8651	8657	8663	8669	8675	8681	8686	6
74	8692	8698	8704	8710	8716	8722	8727	8733	8739	8745	6
75	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802	6
76	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859	6
77	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915	6
78	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971	5
79	8976	8982	8987	8993	8998	9004	9009	9015	9020	9025	6
80	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079	6
81	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133	5
82	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186	5
83	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238	5
84	9243	9248	9253	9258	9263	9269	9274	9279	9284	9289	5
85	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340	5
86	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390	5
87	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440	5
88	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489	5
89	9494	9499	9504	9509	9513	9518	9523	9528	9533	9538	4
90	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586	4
91	9590	9595	9600	9605	9609	9614	9619	9624	9628	9633	5
92	9638	9643	9647	9652	9657	9661	9666	9671	9675	9680	5
93	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727	4
94	9731	9736	9741	9745	9750	9754	9759	9763	9768	9773	4
95	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818	5
96	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863	5
97	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908	4
98	9912	9917	9921	9926	9930	9934	9939	9943	9948	9952	4
99	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996	4
No.	0	1	2	3	4	5	6	7	8	9	Di

NATURAL SINES, TANGENTS AND SECANTS,

ADVANCING BY 10 MIN.

Deg	Min.	Sine.	Tangent	Secant.	Deg	Min.	Sine.	Tangent	Secant.
0	00	.0000	.0000	1.0000	5	00	.0872	.0875	1.0038
	10	.0029	.0029	1.0000		10	.0901	.0904	1.0041
	20	.0058	.0058	1.0000		20	.0929	.0934	1.0043
	30	.0087	.0087	1.0000		30	.0958	.0963	1.0046
	40	.0116	.0116	1.0001		40	.0987	.0992	1.0049
	50	.0145	.0145	1.0001		50	.1016	.1022	1.0052
1	00	.0175	.0175	1.0002	6	00	.1045	.1051	1.0055
	10	.0204	.0204	1.0002		10	.1074	.1080	1.0058
	20	.0233	.0233	1.0003		20	.1103	.1110	1.0061
	30	.0262	.0262	1.0003		30	.1132	.1139	1.0065
	40	.0291	.0291	1.0004		40	.1161	.1169	1.0068
	50	.0320	.0320	1.0005		50	.1190	.1198	1.0072
2	00	.0349	.0349	1.0006	7	00	.1219	.1228	1.0075
	10	.0378	.0378	1.0007		10	.1248	.1257	1.0079
	20	.0407	.0407	1.0008		20	.1276	.1287	1.0082
	30	.0436	.0437	1.0010		30	.1305	.1317	1.0086
	40	.0465	.0466	1.0011		40	.1334	.1346	1.0090
	50	.0494	.0495	1.0012		50	.1363	.1376	1.0094
3	00	.0523	.0524	1.0014	8	00	.1392	.1405	1.0098
	10	.0552	.0553	1.0015		10	.1421	.1435	1.0102
	20	.0581	.0582	1.0017		20	.1449	.1465	1.0107
	30	.0610	.0612	1.0019		30	.1478	.1495	1.0111
	40	.0640	.0641	1.0021		40	.1507	.1524	1.0116
	50	.0669	.0670	1.0022		50	.1536	.1554	1.0120
4	00	.0698	.0699	1.0024	9	00	.1564	.1584	1.0125
	10	.0727	.0729	1.0027		10	.1593	.1614	1.0129
	20	.0756	.0758	1.0029		20	.1622	.1644	1.0134
	30	.0785	.0787	1.0031		30	.1650	.1673	1.0139
	40	.0814	.0816	1.0033		40	.1679	.1703	1.0144
	50	.0843	.0846	1.0036		50	.1708	.1733	1.0149

NATURAL SINES, TANGENTS AND SECANTS.

(CONTINUED.)

Deg	Min.	Sine.	Tangent	Secant.	Deg	Min.	Sine.	Tangent	Secant.
10	00	.1736	.1763	1.0154	15	00	.2588	.2679	1.0353
	10	.1765	.1793	1.0160		10	.2616	.2711	1.0361
	20	.1794	.1823	1.0165		20	.2644	.2742	1.0369
	30	.1822	.1853	1.0170		30	.2672	.2773	1.0377
	40	.1851	.1883	1.0176		40	.2700	.2805	1.0386
	50	.1880	.1914	1.0181		50	.2728	.2836	1.0394
11	00	.1908	.1944	1.0187	16	00	.2756	.2867	1.0403
	10	.1937	.1974	1.0193		10	.2784	.2899	1.0412
	20	.1965	.2004	1.0199		20	.2812	.2931	1.0421
	30	.1994	.2035	1.0205		30	.2840	.2962	1.0429
	40	.2022	.2065	1.0211		40	.2868	.2994	1.0439
	50	.2051	.2095	1.0217		50	.2896	.3026	1.0448
12	00	.2079	.2126	1.0223	17	00	.2924	.3057	1.0457
	10	.2108	.2156	1.0230		10	.2952	.3089	1.0466
	20	.2136	.2186	1.0236		20	.2979	.3121	1.0476
	30	.2164	.2217	1.0243		30	.3007	.3153	1.0485
	40	.2193	.2247	1.0249		40	.3035	.3185	1.0495
	50	.2221	.2278	1.0256		50	.3062	.3217	1.0505
13	00	.2250	.2309	1.0263	18	00	.3090	.3249	1.0515
	10	.2278	.2339	1.0270		10	.3118	.3281	1.0525
	20	.2306	.2370	1.0277		20	.3145	.3314	1.0535
	30	.2334	.2401	1.0284		30	.3173	.3346	1.0545
	40	.2363	.2432	1.0291		40	.3201	.3378	1.0555
	50	.2391	.2462	1.0299		50	.3228	.3411	1.0566
14	00	.2419	.2493	1.0306	19	00	.3256	.3443	1.0576
	10	.2447	.2524	1.0314		10	.3283	.3476	1.0587
	20	.2476	.2555	1.0321		20	.3311	.3508	1.0598
	30	.2504	.2586	1.0329		30	.3338	.3541	1.0608
	40	.2532	.2617	1.0337		40	.3365	.3574	1.0619
	50	.2560	.2648	1.0345		50	.3393	.3607	1.0631

NATURAL SINES, TANGENTS AND SECANTS.

(CONTINUED.)

Deg	Min.	Sine.	Tangent	Secant.	Deg	Min.	Sine.	Tangent	Secant.
20	00	.3420	.3640	1.0642	**25**	00	.4226	.4663	1.1034
	10	.3448	.3673	1.0653		10	.4253	.4699	1.1049
	20	.3475	.3706	1.0665		20	.4279	.4734	1.1064
	30	.3502	.3739	1.0676		30	.4305	.4770	1.1079
	40	.3529	.3772	1.0688		40	.4331	.4806	1.1095
	50	.3557	.3805	1.0700		50	.4358	.4841	1.1110
21	00	.3584	.3839	1.0711	**26**	00	.4384	.4877	1.1126
	10	.3611	.3872	1.0723		10	.4410	.4913	1.1142
	20	.3638	.3906	1.0736		20	.4436	.4950	1.1158
	30	.3665	.3939	1.0748		30	.4462	.4986	1.1174
	40	.3692	.3973	1.0760		40	.4488	.5022	1.1190
	50	.3719	.4006	1.0773		50	.4514	.5059	1.1207
22	00	.3746	.4040	1.0785	**27**	00	.4540	.5095	1.1223
	10	.3773	.4074	1.0798		10	.4566	.5132	1.1240
	20	.3800	.4108	1.0811		20	.4592	.5169	1.1257
	30	.3827	.4142	1.0824		30	.4617	.5206	1.1274
	40	.3854	.4176	1.0837		40	.4643	.5243	1.1291
	50	.3881	.4210	1.0850		50	.4669	.5280	1.1308
23	00	.3907	.4245	1.0864	**28**	00	.4695	.5317	1.1326
	10	.3934	.4279	1.0877		10	.4720	.5354	1.1343
	20	.3961	.4314	1.0891		20	.4746	.5392	1.1361
	30	.3987	.4348	1.0904		30	.4772	.5430	1.1379
	40	.4014	.4383	1.0918		40	.4797	.5467	1.1397
	50	.4041	.4417	1.0932		50	.4823	.5505	1.1415
24	00	.4067	.4452	1.0946	**29**	00	.4848	.5543	1.1434
	10	.4094	.4487	1.0961		10	.4874	.5581	1.1452
	20	.4120	.4522	1.0975		20	.4899	.5619	1.1471
	30	.4147	.4557	1.0989		30	.4924	.5658	1.1490
	40	.4173	.4592	1.1004		40	.4950	.5696	1.1509
	50	.4200	.4628	1.1019		50	.4975	.5735	1.1528

NATURAL SINES, TANGENTS AND SECANTS.

(CONTINUED.)

Deg	Min.	Sine.	Tangent	Secant.	Deg	Min.	Sine.	Tangent	Secant.
30	00	.5000	.5774	1.1547	35	00	.5736	.7002	1.2208
	10	.5025	.5812	1.1566		10	.5760	.7046	1.2233
	20	.5050	.5851	1.1586		20	.5783	.7089	1.2258
	30	.5075	.5890	1.1606		30	.5807	.7133	1.2283
	40	.5100	.5930	1.1626		40	.5831	.7177	1.2309
	50	.5125	.5969	1.1646		50	.5854	.7221	1.2335
31	00	.5150	.6009	1.1666	36	00	.5878	.7265	1.2361
	10	.5175	.6048	1.1687		10	.5901	.7310	1.2387
	20	.5200	.6088	1.1707		20	.5925	.7355	1.2413
	30	.5225	.6128	1.1728		30	.5948	.7400	1.2440
	40	.5250	.6168	1.1749		40	.5972	.7445	1.2467
	50	.5275	.6208	1.1770		50	.5995	.7490	1.2494
32	00	.5299	.6249	1.1792	37	00	.6018	.7536	1.2521
	10	.5324	.6289	1.1813		10	.6041	.7581	1.2549
	20	.5348	.6330	1.1835		20	.6065	.7627	1.2577
	30	.5373	.6371	1.1857		30	.6088	.7673	1.2605
	40	.5398	.6412	1.1879		40	.6111	.7720	1.2633
	50	.5422	.6453	1.1901		50	.6134	.7766	1.2661
33	00	.5446	.6494	1.1924	38	00	.6157	.7813	1.2690
	10	.5471	.6536	1.1946		10	.6180	.7860	1.2719
	20	.5495	.6577	1.1969		20	.6202	.7907	1.2748
	30	.5519	.6619	1.1992		30	.6225	.7954	1.2778
	40	.5544	.6661	1.2015		40	.6248	.8002	1.2808
	50	.5568	.6703	1.2039		50	.6271	.8050	1.2837
34	00	.5592	.6745	1.2062	39	00	.6293	.8098	1.2868
	10	.5616	.6787	1.2086		10	.6316	.8146	1.2898
	20	.5640	.6830	1.2110		20	.6338	.8195	1.2929
	30	.5664	.6873	1.2134		30	.6361	.8243	1.2960
	40	.5688	.6916	1.2158		40	.6383	.8292	1.2991
	50	.5712	.6959	1.2183		50	.6406	.8342	1.3022

NATURAL SINES, TANGENTS AND SECANTS.

(CONTINUED.)

Deg	Min.	Sine.	Tangent	Secant.	Deg	Min.	Sine.	Tangent	Secant.
40	00	.6428	.8391	1.3054	45	00	.7071	1.0000	1.4142
	10	.6450	.8441	1.3086		10	.7092	1.0058	1.4183
	20	.6472	.8491	1.3118		20	.7112	1.0117	1.4225
	30	.6494	.8541	1.3151		30	.7133	1.0176	1.4267
	40	.6517	.8591	1.3184		40	.7153	1.0235	1.4310
	50	.6539	.8642	1.3217		50	.7173	1.0295	1.4352
41	00	.6561	.8693	1.3250	46	00	.7193	1.0355	1.4396
	10	.6583	.8744	1.3284		10	.7214	1.0416	1.4439
	20	.6604	.8796	1.3318		20	.7234	1.0477	1.4483
	30	.6626	.8847	1.3352		30	.7254	1.0538	1.4527
	40	.6648	.8899	1.3386		40	.7274	1.0599	1.4572
	50	.6670	.8952	1.3421		50	.7294	1.0661	1.4617
42	00	.6691	.9004	1.3456	47	00	.7314	1.0724	1.4663
	10	.6713	.9057	1.3492		10	.7333	1.0786	1.4709
	20	.6734	.9110	1.3527		20	.7353	1.0850	1.4755
	30	.6756	.9163	1.3563		30	.7373	1.0913	1.4802
	40	.6777	.9217	1.3600		40	.7392	1.0977	1.4849
	50	.6799	.9271	1.3636		50	.7412	1.1041	1.4897
43	00	.6820	.9325	1.3673	48	00	.7431	1.1106	1.4945
	10	.6841	.9380	1.3711		10	.7451	1.1171	1.4993
	20	.6862	.9435	1.3748		20	.7470	1.1237	1.5042
	30	.6884	.9490	1.3786		30	.7490	1.1303	1.5092
	40	.6905	.9545	1.3824		40	.7509	1.1369	1.5141
	50	.6926	.9601	1.3863		50	.7528	1.1436	1.5192
44	00	.6947	.9657	1.3902	49	00	.7547	1.1504	1.5243
	10	.6967	.9713	1.3941		10	.7566	1.1571	1.5294
	20	.6988	.9770	1.3980		20	.7585	1.1640	1.5345
	30	.7009	.9827	1.4020		30	.7604	1.1708	1.5398
	40	.7030	.9884	1.4061		40	.7623	1.1778	1.5450
	50	.7050	.9942	1.4101		50	.7642	1.1847	1.5504

NATURAL SINES, TANGENTS AND SECANTS.

(CONTINUED.)

Deg	Min.	Sine.	Tangent	Secant.	Deg	Min.	Sine.	Tangent	Secant.
50	00	.7660	1.1918	1.5557	55	00	.8192	1.4281	1.7434
	10	.7679	1.1988	1.5611		10	.8208	1.4370	1.7507
	20	.7698	1.2059	1.5666		20	.8225	1.4460	1.7581
	30	.7716	1.2131	1.5721		30	.8241	1.4550	1.7655
	40	.7735	1.2203	1.5777		40	.8258	1.4641	1.7730
	50	.7753	1.2276	1.5833		50	.8274	1.4733	1.7806
51	00	.7771	1.2349	1.5890	56	00	.8290	1.4826	1.7883
	10	.7790	1.2423	1.5948		10	.8307	1.4919	1.7960
	20	.7808	1.2497	1.6005		20	.8323	1.5013	1.8039
	30	.7826	1.2572	1.6064		30	.8339	1.5108	1.8118
	40	.7844	1.2647	1.6123		40	.8355	1.5204	1.8198
	50	.7862	1.2723	1.6183		50	.8371	1.5301	1.8279
52	00	.7880	1.2799	1.6243	57	00	.8387	1.5399	1.8361
	10	.7898	1.2876	1.6303		10	.8403	1.5497	1.8443
	20	.7916	1.2954	1.6365		20	.8418	1.5597	1.8527
	30	.7934	1.3032	1.6427		30	.8434	1.5697	1.8612
	40	.7951	1.3111	1.6489		40	.8450	1.5798	1.8699
	50	.7969	1.3190	1.6553		50	.8465	1.5900	1.8783
53	00	.7986	1.3270	1.6616	58	00	.8480	1.6003	1.8871
	10	.8004	1.3352	1.6681		10	.8496	1.6107	1.8959
	20	.8021	4.3432	1.6746		20	.8511	1.6213	1.9048
	30	.8039	1.3514	1.6812		30	.8526	1.6319	1.9139
	40	.8056	1.3597	1.6878		40	.8542	1.6426	1.9230
	50	.8073	1.3680	1.6945		50	.8557	1.6534	1.9323
54	00	.8090	1.3764	1.7013	59	00	.8572	1.6643	1.9416
	10	.8107	1.3848	1.7081		10	.8587	1.6753	1.9511
	20	.8124	1.3934	1.7151		20	.8601	1.6864	1.9606
	30	.8141	1.4019	1.7221		30	.8616	1.6977	1.9703
	40	.8158	1.4106	1.7291		40	.8631	1.7090	1.9801
	50	.8175	1.4193	1.7362		50	.8646	1.7205	1.9900

NATURAL SINES, TANGENTS AND SECANTS.

(CONTINUED.)

Deg	Min.	Sine.	Tangent	Secant.	Deg	Min.	Sine.	Tangent	Secant.
60	00	.8660	1.7321	2.0000	65	00	.9063	2.1445	2.3662
	10	.8675	1.7437	2.0101		10	.9075	2.1609	2.3811
	20	.8689	1.7556	2.0204		20	.9088	2.1775	2.3961
	30	.8704	1.7675	2.0308		30	.9100	2.1943	2.4114
	40	.8718	1.7796	2.0413		40	.9112	2.2113	2.4269
	50	.8732	1.7917	2.0519		50	.9124	2.2286	2.4426
61	00	.8746	1.8040	2.0627	66	00	.9135	2.2460	2.4586
	10	.8760	1.8165	2.0736		10	.9147	2.2637	2.4748
	20	.8774	1.8291	2.0846		20	.9159	2.2817	2.4912
	30	.8788	1.8418	2.0957		30	.9171	2.2998	2.5078
	40	.8802	1.8546	2.1070		40	.9182	2.3183	2.5247
	50	.8816	1.8676	2.1185		50	.9194	2.3369	2.5419
62	00	.8829	1.8807	2.1301	67	00	.9205	2.3559	2.5593
	10	.8843	1.8940	2.1418		10	.9216	2.3750	2.5770
	20	.8857	1.9074	2.1537		20	.9228	2.3945	2.5949
	30	.8870	1.9210	2.1657		30	.9239	2.4141	2.6131
	40	.8884	1.9347	2.1786		40	.9250	2.4342	2.6316
	50	.8897	1.9486	2.1902		50	.9261	2.4545	2.6504
63	00	.8910	1.9626	2.2027	68	00	.9272	2.4751	2.6695
	10	.8923	1.9768	2.2153		10	.9283	2.4960	2.6888
	20	.8936	1.9912	2.2282		20	.9293	2.5172	2.7085
	30	.8949	2.0057	2.2412		30	.9304	2.5386	2.7285
	40	.8962	2.0204	2.2543		40	.9315	2.5605	2.7488
	50	.8975	2.0353	2.2677		50	.9325	2.5826	2.7695
64	00	.8988	2.0503	2.2812	69	00	.9336	2.6051	2.7904
	10	.9001	2.0655	2.2949		10	.9346	2.6279	2.8117
	20	.9013	2.0809	2.3088		20	.9356	2.6511	2.8334
	30	.9026	2.0965	2.3228		30	.9367	2.6746	2.8555
	40	.9038	2.1123	2.3371		40	.9377	2.6985	2.8779
	50	.9051	2.1283	2.3515		50	.9387	2.7228	2.9006

NATURAL SINES, TANGENTS AND SECANTS.

(CONTINUED.)

Deg	Min.	Sine.	Tangent	Secant.	Deg	Min.	Sine.	Tangent	Secant.
70	00	.9397	2.7475	2.9238	75	00	.9659	3.7321	3.8637
	10	.9407	2.7725	2.9474		10	.9667	3.7760	3.9061
	20	.9417	2.7980	2.9713		20	.9674	3.8208	3.9495
	30	.9426	2.8239	2.9957		30	.9681	3.8667	3.9939
	40	.9436	2.8502	3.0206		40	.9689	3.9136	4.0394
	50	.9446	2.8770	3.0458		50	.9696	3.9617	4.0859
71	00	.9455	2.9042	3.0716	76	00	.9703	4.0108	4.1336
	10	.9465	2.9319	3.0977		10	.9710	4.0611	4.1824
	20	.9474	2.9600	3.1244		20	.9717	4.1126	4.2324
	30	.9483	2.9887	3.1515		30	.9724	4.1653	4.2837
	40	.9492	3.0178	3.1792		40	.9730	4.2193	4.3362
	50	.9502	3.0475	3.2074		50	.9737	4.2747	4.3901
72	00	.9511	3.0777	3.2361	77	00	.9744	4.3315	4.4454
	10	.9520	3.1084	3.2653		10	.9750	4.3897	4.5022
	20	.9528	3.1397	3.2951		20	.9757	4.4494	4.5604
	30	.9537	3.1716	3.3255		30	.9763	4.5107	4.6202
	40	.9546	3.2041	3.3565		40	.9769	4.5736	4.6817
	50	.9555	3.2371	3.3881		50	.9775	4.6382	4.7448
73	00	.9563	3.2709	3.4203	78	00	.9781	4.7046	4.8097
	10	.9572	3.3052	3.4532		10	.9787	4.7729	4.8765
	20	.9580	3.3402	3.4867		20	.9793	4.8430	4.9452
	30	.9588	3.3759	3.5209		30	.9799	4.9152	5.0159
	40	.9596	3.4124	3.5559		40	.9805	4.9894	5.0886
	50	.9605	3.4495	3.5915		50	.9811	5.0658	5.1636
74	00	.9613	3.4874	3.6280	79	00	.9816	5.1446	5.2408
	10	.9621	3.5261	3.6652		10	.9822	5.2257	5.3205
	20	.9628	3.5656	3.7032		20	.9827	5.3093	5.4026
	30	.9636	3.6059	3.7420		30	.9833	5.3955	5.4874
	40	.9644	3.6470	3.7817		40	.9838	5.4845	5.5749
	50	.9652	3.6891	3.8222		50	.9843	5.5764	5.6653

NATURAL SINES, TANGENTS AND SECANTS.

(CONTINUED.)

Deg	Min.	Sine.	Tangent	Secant.	Deg	Min.	Sine.	Tangent	Secant.
80	00	.9848	5.6713	5.7588	85	00	.9962	11.430	11.474
	10	.9853	5.7694	5.8554		10	.9964	11.826	11.868
	20	.9858	5.8708	5.9554		20	.9967	12.251	12.291
	30	.9863	5.9758	6.0589		30	.9969	12.706	12.745
	40	.9868	6.0844	6.1661		40	.9971	13.197	13.235
	50	.9872	6.1970	6.2772		50	.9974	13.727	13.763
81	00	.9877	6.3138	6.3925	86	00	.9976	14.301	14.336
	10	.9881	6.4348	6.5121		10	.9978	14.924	14.958
	20	.9886	6.5606	6.6363		20	.9980	15.605	15.637
	30	.9890	6.6912	6.7655		30	.9981	16.350	16.380
	40	.9894	6.8269	6.8998		40	.9983	17.169	17.198
	50	.9899	6.9682	7.0396		50	.9985	18.075	18.103
82	00	.9903	7.1154	7.1853	87	00	.9986	19.081	19.107
	10	.9907	7.2687	7.3372		10	.9988	20.206	20.230
	20	.9911	6.4287	7.4957		20	.9989	21.470	21.494
	30	.9914	7.5958	7.6613		30	.9990	22.904	22.926
	40	.9918	7.7704	7.8344		40	.9992	24.542	24.562
	50	.9922	7.9530	8.0156		50	.9993	26.432	26.451
83	00	.9925	8.1443	8.2055	88	00	.9994	28.636	28.654
	10	.9929	8.3450	8.4047		10	.9995	31.242	31.258
	20	.9932	8.5555	8.6138		20	.9996	34.368	34.382
	30	.9936	8.7769	8.8337		30	.9997	38.188	38.202
	40	.9939	9.0098	9.0652		40	.9997	42.964	42.976
	50	.9942	9.2553	9.3092		50	.9998	49.104	49.114
84	00	.9945	9.5144	9.5668	89	00	.9998	57.290	57.299
	10	.9948	9.7882	9.8391		10	.9999	68.750	68.757
	20	.9951	10.0780	10.1275		20	.9999	85.940	85.946
	30	.9954	10.3854	10.4334		30	1.0000	114.589	114.593
	40	.9957	10.7119	10.7585		40	1.0000	171.885	171.888
	50	.9959	11.0594	11.1045		50	1.0000	343.774	343.775
					90	00	1.0000	Infinite.	Infinite.

SQUARES, CUBES, SQUARE ROOTS & CUBE ROOTS.

Nos.	Squares.	Cubes.	Square Root.	Cube Root.	Nos.	Squares.	Cubes.	Square Root.	Cube Root.
1	1	1	1.000	1.080	51	26 01	132 651	7.141	3.708
2	4	8	1.414	1.260	52	27 04	140 608	7.211	3.733
3	9	27	1.732	1.442	53	28 09	148 877	7.280	3.756
4	16	64	2.000	1.587	54	29 16	157 464	7.349	3.780
5	25	125	2.236	1.710	55	30 25	166 375	7.416	3.808
6	36	216	2.449	1.817	56	31 36	175 616	7.483	3.826
7	49	343	2.646	1.913	57	32 49	185 193	7.550	3.849
8	64	512	2.828	2.000	58	33 64	195 112	7.616	3.871
9	81	729	3.000	2.080	59	34 81	205 379	7.681	3.893
10	1 00	1 000	3.162	2.154	60	36 00	216 000	7.746	3.915
11	1 21	1 331	3.317	2.224	61	37 21	226 981	7.810	3.937
12	1 44	1 728	3.464	2.289	62	38 44	238 328	7.874	3.956
13	1 69	2 197	3.606	2.351	63	39 69	250 047	7.937	3.979
14	1 96	2 744	3.742	2.410	64	40 96	262 144	8.000	4.000
15	2 25	3 375	3.873	2.466	65	42 25	274 625	8.062	4.021
16	2 56	4 096	4.000	2.520	66	43 56	287 496	8.124	4.041
17	2 89	4 913	4.123	2.571	67	44 89	300 763	8.185	4.062
18	3 24	5 832	4.243	2.621	68	46 24	314 432	8.246	4.082
19	3 61	6 859	4.359	2.668	69	47 61	328 509	8.307	4.102
20	4 00	8 000	4.472	2.714	70	49 00	343 000	8.367	4.121
21	4 41	9 261	4.583	2.759	71	50 41	357 911	8.426	4.141
22	4 84	10 648	4.690	2.802	72	51 84	373 248	8.485	4.160
23	5 29	12 167	4.796	2.844	73	53 29	389 017	8.544	4.179
24	5 76	13 824	4.899	2.885	74	54 76	405 224	8.602	4.198
25	6 25	15 625	5.000	2.924	75	56 25	421 875	8.660	4.217
26	6 76	17 576	5.099	2.963	76	57 76	438 976	8.718	4.236
27	7 29	19 683	5.196	3.000	77	59 29	456 533	8.775	4.254
28	7 84	21 952	5.292	3.037	78	60 84	474 552	8.832	4.273
29	8 41	24 389	5.385	3.072	79	62 41	493 039	8.888	4.291
30	9 00	27 000	5.477	3.107	80	64 00	512 000	8.944	4.309
31	9 61	29 791	5.568	3.141	81	65 61	531 441	9.000	4.327
32	10 24	32 768	5.657	3.175	82	67 24	551 368	9.055	4.345
33	10 89	35 937	5.745	3.208	83	68 89	571 787	9.110	4.362
34	11 56	39 304	5.831	3.240	84	70 56	592 704	9.165	4.380
35	12 25	42 875	5.916	3.271	85	72 25	614 125	9.220	4.397
36	12 96	46 656	6.000	3.302	86	73 96	636 056	9.274	4.414
37	13 69	50 653	6.083	3.332	87	75 69	658 503	9.327	4.431
38	14 44	54 872	6.164	3.362	88	77 44	681 472	9.381	4.448
39	15 21	59 319	6.245	3.391	89	79 21	704 969	9.434	4.465
40	16 00	64 000	6.325	3.420	90	81 00	729 000	9.487	4.481
41	16 81	68 921	6.403	3.448	91	82 81	753 571	9.539	4.498
42	17 64	74 088	6.481	3.476	92	84 64	778 688	9.592	4.514
43	18 49	79 507	6.557	3.503	93	86 49	804 357	9 644	4.531
44	19 36	85 184	6.633	3.530	94	88 36	830 584	9.695	4.547
45	20 25	91 125	6.708	3.557	95	90 25	857 375	9.747	4.563
46	21 16	97 336	6.782	3.583	96	92 16	884 736	9.798	4.579
47	22 09	103 823	6.856	3.609	97	94 09	912 673	9.849	4.595
48	23 04	110 592	6.928	3.634	98	96 04	941 192	9.900	4.610
49	24 01	117 649	7.000	3.659	99	98 01	970 299	9.950	4.626
50	25 00	125 000	7.071	3.684	100	1 00 00	1 000 000	10.000	4.642

SQUARES, CUBES, SQUARE ROOTS & CUBE ROOTS.

(CONTINUED)

Nos.	Squares.	Cubes.	Square Root.	Cube Root.	Nos.	Squares.	Cubes.	Square Root.	Cube Root.
101	1 02 01	1 030 301	10.0499	4.6570	151	2 28 01	3 442 951	12.2882	5.3251
102	1 04 04	1 061 208	10.0995	4.6723	152	2 31 04	3 511 808	12.3288	5.3368
103	1 06 09	1 092 727	10.1489	4.6875	153	2 34 09	3 581 577	12.3693	5.3485
104	1 08 16	1 124 864	10.1980	4.7027	154	2 37 16	3 652 264	12.4097	5.3601
105	1 10 25	1 157 625	10.2470	4.7177	155	2 40 25	3 723 875	12.4499	5.3717
106	1 12 36	1 191 016	10.2956	4.7326	156	2 43 36	3 796 416	12.4900	5.3832
107	1 14 49	1 225 043	10.3441	4.7475	157	2 46 49	3 869 893	12.5300	5.3947
108	1 16 64	1 259 712	10.3923	4.7622	158	2 49 64	3 944 312	12.5698	5.4061
109	1 18 81	1 295 029	10.4403	4.7769	159	2 52 81	4 019 679	12.6095	5.4175
110	1 21 00	1 331 000	10.4881	4.7914	160	2 56 00	4 096 000	12.6491	5.4288
111	1 23 21	1 367 631	10.5357	4.8059	161	2 59 21	4 173 281	12.6886	5.4401
112	1 25 44	1 404 928	10.5830	4.8203	162	2 62 44	4 251 528	12.7279	5.4514
113	1 27 69	1 442 897	10.6301	4.8346	163	2 65 69	4 330 747	12.7671	5.4626
114	1 29 96	1 481 544	10.6771	4.8488	164	2 68 96	4 410 944	12.8062	5.4737
115	1 32 25	1 520 875	10.7238	4.8629	165	2 72 25	4 492 125	12.8452	5.4848
116	1 34 56	1 560 896	10.7703	4.8770	166	2 75 56	4 574 296	12.8841	5.4959
117	1 36 89	1 601 613	10.8167	4.8910	167	2 78 89	4 657 463	12.9228	5.5069
118	1 39 24	1 643 032	10.8628	4.9049	168	2 82 24	4 741 632	12.9615	5.5178
119	1 41 61	1 685 159	10.9087	4.9187	169	2 85 61	4 826 809	13.0000	5.5288
120	1 44 00	1 728 000	10.9545	4.9324	170	2 89 00	4 913 000	13.0384	5.5397
121	1 46 41	1 771 561	11.0000	4.9461	171	2 92 41	5 000 211	13.0767	5.5505
122	1 48 84	1 815 848	11.0454	4.9597	172	2 95 84	5 088 448	13.1149	5.5613
123	1 51 29	1 860 867	11.0905	4.9732	173	2 99 29	5 177 717	13.1529	5.5721
124	1 53 76	1 906 624	11.1355	4.9866	174	3 02 76	5 268 024	13.1909	5.5828
125	1 56 25	1 953 125	11.1803	5.0000	175	3 06 25	5 359 375	13.2288	5.5934
126	1 58 76	2 000 376	11.2250	5.0133	176	3 09 76	5 451 776	13.2665	5.6041
127	1 61 29	2 048 383	11.2694	5.0265	177	3 13 29	5 545 233	13.3041	5.6147
128	1 63 84	2 097 152	11.3137	5.0397	178	3 16 84	5 639 752	13.3417	5.6252
129	1 66 41	2 146 689	11.3578	5.0528	179	3 20 41	5 735 339	13.3791	5.6357
130	1 69 00	2 197 000	11.4018	5.0658	180	3 24 00	5 832 000	13.4164	5.6462
131	1 71 60	2 248 091	11.4455	5.0788	181	3 27 61	5 929 741	13.4536	5.6567
132	1 74 24	2 299 968	11.4891	5.0916	182	3 31 24	6 028 568	13.4907	5.6671
133	1 76 89	2 352 637	11.5326	5.1045	183	3 34 89	6 128 487	13.5277	5.6774
134	1 79 56	2 406 104	11.5758	5.1172	184	3 38 56	6 229 504	13.5647	5.6877
135	1 82 25	2 460 375	11.6190	5.1299	185	3 42 25	6 331 625	13.6015	5.6980
136	1 84 96	2 515 456	11.6619	5.1426	186	3 45 96	6 434 856	13.6382	5.7083
137	1 87 69	2 571 353	11.7047	5.1551	187	3 49 69	6 539 203	13.6748	5.7185
138	1 90 44	2 628 072	11.7473	5.1676	188	3 53 44	6 644 672	13.7113	5.7287
139	1 93 21	2 685 619	11.7898	5.1801	189	3 57 21	6 751 269	13.7477	5.7388
140	1 96 00	2 744 000	11.8322	5.1925	190	3 61 00	6 859 000	13.7840	5.7489
141	1 98 81	2 803 221	11.8743	5.2048	191	3 64 81	6 967 871	13.8203	5.7590
142	2 01 64	2 863 288	11.9164	5.2171	192	3 68 64	7 077 888	13.8564	5.7690
143	2 04 49	2 924 207	11.9583	5.2293	193	3 72 49	7 189 057	13.8924	5.7790
144	2 07 36	2 985 984	12.0000	5.2415	194	3 76 36	7 301 384	13.9284	5.7890
145	2 10 25	3 048 625	12.0416	5.2536	195	3 80 25	7 414 875	13.9642	5.7989
146	2 13 16	3 112 136	12.0830	5.2656	196	3 84 16	7 529 536	14.0000	5.8088
147	2 16 09	3 176 523	12.1244	5.2776	197	3 88 09	7 645 373	14.0357	5.8186
148	2 19 04	3 241 792	12.1655	5.2896	198	3 92 04	7 762 392	14.0712	5.8285
149	2 22 01	3 307 949	12.2066	5.3015	199	3 96 01	7 880 599	14.1067	5.8383
150	2 25 00	3 375 000	12.2474	5.3133	200	4 00 00	8 000 000	14.1421	5.8480

SQUARES, CUBES, SQUARE ROOTS & CUBE ROOTS.
(CONTINUED.)

Nos.	Squares.	Cubes.	Square Root.	Cube Root.	Nos.	Squares.	Cubes.	Square Root.	Cube Root.
201	4 04 01	8 120 601	14.1774	5.8578	251	6 30 01	15 813 251	15.8430	6.3080
202	4 08 04	8 242 408	14.2127	5.8675	252	6 35 04	16 006 008	15.8745	6.3164
203	4 12 09	8 365 427	14.2478	5.8771	253	6 40 09	16 194 277	15.9060	6.3247
204	4 16 16	8 489 664	14.2829	5.8868	254	6 45 16	16 387 064	15.9374	6.3330
205	4 20 25	8 615 125	14.3178	5.8964	255	6 50 25	16 581 375	15.9687	6.3413
206	4 24 36	8 741 816	14.3527	5.9059	256	6 55 36	16 777 216	16.0000	6.3496
207	4 28 49	8 869 743	14.3875	5.9155	257	6 60 49	16 974 593	16.0312	6.3579
208	4 32 64	8 998 912	14.4222	5.9250	258	6 65 64	17 173 512	16.0624	6.3661
209	4 36 81	9 129 329	14.4568	5.9345	259	6 70 81	17 373 979	16.0935	6.3743
210	4 41 00	9 261 000	14.4914	5.9439	260	6 76 00	17 576 000	16.1245	6.3825
211	4 45 21	9 393 931	14.5258	5.9533	261	6 81 21	17 779 581	16.1555	6.3907
212	4 49 44	9 528 128	14.5602	5.9627	262	6 86 44	17 984 728	16.1864	6.3988
213	4 53 69	9 663 597	14.5945	5.9721	263	6 91 69	18 191 447	16.2173	6.4070
214	4 57 96	9 800 344	14.6287	5.9814	264	6 96 96	18 399 744	16.2481	6.4151
215	4 62 25	9 938 375	14.6629	5.9907	265	7 02 25	18 609 625	16.2788	6.4232
216	4 66 56	10 077 696	14.6969	6.0000	266	7 07 56	18 821 096	16.3095	6.4312
217	4 70 89	10 218 313	14.7309	6.0092	267	7 12 89	19 034 163	16.3401	6.4393
218	4 75 24	10 360 232	14.7648	6.0185	268	7 18 24	19 248 832	16.3707	6.4473
219	4 79 61	10 503 459	14.7986	6.0277	269	7 23 61	19 465 109	16.4012	6.4553
220	4 84 00	10 648 000	14.8324	6.0368	270	7 29 00	19 683 000	16.4317	6.4633
221	4 88 41	10 793 861	14.8661	6.0459	271	7 34 41	19 902 511	16.4621	6.4713
222	4 92 84	10 941 048	14.8997	6.0550	272	7 39 84	20 123 648	16.4924	6.4792
223	4 97 29	11 089 567	14.9332	6.0641	273	7 45 29	20 346 417	16.5227	6.4872
224	5 01 76	11 239 424	14.9666	6.0732	274	7 50 76	20 570 824	16.5529	6.4951
225	5 06 25	11 390 625	15.0000	6.0822	275	7 56 25	20 796 875	16.5831	6.5030
226	5 10 76	11 543 176	15.0333	6.0912	276	7 61 76	21 024 576	16.6132	6.5108
227	5 15 29	11 697 083	15.0665	6.1002	277	7 67 29	21 253 933	16.6433	6.5187
228	5 19 84	11 852 352	15.0997	6.1091	278	7 72 84	21 484 952	16.6733	6.5265
229	5 24 41	12 008 989	15.1327	6.1180	279	7 78 41	21 717 639	16.7033	6.5343
230	5 29 00	12 167 000	15.1658	6.1269	280	7 84 00	21 952 000	16.7332	6.5421
231	5 33 61	12 326 391	15.1987	6.1358	281	7 89 61	22 188 041	16.7631	6.5499
232	5 38 24	12 487 168	15.2315	6.1446	282	7 95 24	22 425 768	16.7929	6.5577
233	5 42 89	12 649 337	15.2643	6.1534	283	8 00 89	22 665 187	16.8226	6.5654
234	5 47 56	12 812 904	15.2971	6.1622	284	8 06 56	22 906 304	16.8523	6.5731
235	5 52 25	12 977 875	15.3297	6.1710	285	8 12 25	23 149 125	16.8819	6.5808
236	5 56 96	13 144 256	15.3623	6.1797	286	8 17 96	23 393 656	16.9115	6.5885
237	5 61 69	13 312 053	15.3948	6.1885	287	8 23 69	23 639 903	16.9411	6.5962
238	5 66 44	13 481 272	15.4272	6.1972	288	8 29 44	23 887 872	16.9706	6.6039
239	5 71 21	13 651 919	15.4596	6.2058	289	8 35 21	24 137 569	17.0000	6.6115
240	5 76 00	13 824 000	15.4919	6.2145	290	8 41 00	24 389 000	17.0294	6.6191
241	5 80 81	13 997 521	15.5242	6.2231	291	8 46 81	24 642 171	17.0587	6.6267
242	5 85 64	14 172 488	15.5563	6.2317	292	8 52 64	24 897 088	17.0880	6.6343
243	5 90 49	14 348 907	15.5885	6.2403	293	8 58 49	25 153 757	17.1172	6.6419
244	5 95 36	14 526 784	15.6205	6.2488	294	8 64 36	25 412 184	17.1464	6.6494
245	6 00 25	14 706 125	15.6525	6.2573	295	8 70 25	25 672 375	17.1756	6.6569
246	6 05 16	14 886 936	15.6844	6.2658	296	8 76 16	25 934 336	17.2047	6.6644
247	6 10 09	15 069 223	15.7162	6.2743	297	8 82 09	26 198 073	17.2337	6.6719
248	6 15 04	15 252 992	15.7480	6.2828	298	8 88 04	26 463 592	17.2627	6.6794
249	6 20 01	15 438 249	15.7797	6.2912	299	8 94 01	26 730 899	17.2916	6.6869
250	6 25 00	15 625 000	15.8114	6.2996	300	9 00 00	27 000 000	17.3205	6.6943

SQUARES, CUBES, SQUARE ROOTS & CUBE ROOTS.

(CONTINUED.)

Nos.	Squares.	Cubes.	Square Root.	Cube Root.	Nos.	Squares.	Cubes.	Square Root.	Cube Root.
301	9 06 01	27 270 901	17.3494	6.7018	351	12 32 01	43 243 551	18.7350	7.0540
302	9 12 04	27 543 608	17.3781	6.7092	352	12 39 04	43 614 208	18.7617	7.0607
303	9 18 09	27 818 127	17.4069	6.7166	353	12 46 09	43 986 977	18.7883	7.0674
304	9 24 16	28 094 464	17.4356	6.7240	354	12 53 16	44 361 864	18.8149	7.0740
305	9 30 25	28 372 625	17.4642	6.7313	355	12 60 25	44 738 875	18.8414	7.0807
306	9 36 36	28 652 616	17.4929	6.7387	356	12 67 36	45 118 016	18.8680	7.0873
307	9 42 49	28 934 443	17.5214	6.7460	357	12 74 49	45 499 293	18.8944	7.0940
308	9 48 64	29 218 112	17.5499	6.7533	358	12 81 64	45 882 712	18.9209	7.1006
309	9 54 81	29 503 629	17.5784	6.7606	359	12 88 81	46 268 279	18.9473	7.1072
310	9 61 00	29 791 000	17.6068	6.7679	360	12 96 00	46 656 000	18.9737	7.1138
311	9 67 21	30 080 231	17.6352	6.7752	361	13 03 21	47 045 881	19.0000	7.1204
312	9 73 44	30 371 328	17.6635	6.7824	362	13 10 44	47 437 928	19.0263	7.1269
313	9 79 69	30 664 297	17.6918	6.7897	363	13 17 69	47 832 147	19.0526	7.1335
314	9 85 96	30 959 144	17.7200	6.7969	364	13 24 96	48 228 544	19.0788	7.1400
315	9 92 25	31 255 875	17.7482	6.8041	365	13 32 25	48 627 125	19.1050	7.1466
316	9 98 56	31 554 496	17.7764	6.8113	366	13 39 56	49 027 896	19.1311	7.1531
317	10 04 89	31 855 013	17.8045	6.8185	367	13 46 89	49 430 863	19.1572	7.1596
318	10 11 24	32 157 432	17.8326	6.8256	368	13 54 24	49 836 032	19.1833	7.1661
319	10 17 61	32 461 759	17.8606	6.8328	369	13 61 61	50 243 409	19.2094	7.1726
320	10 24 00	32 768 000	17.8885	6.8399	370	13 69 00	50 653 000	19.2354	7.1791
321	10 30 41	33 076 161	17.9165	6.8470	371	13 76 41	51 064 811	19.2614	7.1855
322	10 36 84	33 386 248	17.9444	6.8541	372	13 83 84	51 478 848	19.2873	7.1920
323	10 43 29	33 698 267	17.9722	6.8612	373	13 91 29	51 895 117	19.3132	7.1984
324	10 49 76	34 012 224	18.0000	6.8683	374	13 98 76	52 313 624	19.3391	7.2048
325	10 56 25	34 328 125	18.0278	6.8753	375	14 06 25	52 734 375	19.3649	7.2112
326	10 62 76	34 645 976	18.0555	6.8824	376	14 13 76	53 157 376	19.3907	7.2177
327	10 69 29	34 965 783	18.0831	6.8894	377	14 21 29	53 582 633	19.4165	7.2240
328	10 75 84	35 287 552	18.1108	6.8964	378	14 28 84	54 010 152	19.4422	7.2304
329	10 82 41	35 611 289	18.1384	6.9034	379	14 36 41	54 439 939	19.4679	7.2368
330	10 89 00	35 937 000	18.1659	6.9104	380	14 44 00	54 872 000	19.4936	7.2432
331	10 95 61	36 264 691	18.1934	6.9174	381	14 51 61	55 306 341	19.5192	7.2495
332	11 02 24	36 594 368	18.2209	6.9244	382	14 59 24	55 742 968	19.5448	7.2558
333	11 08 89	36 926 037	18.2483	6.9313	383	14 66 89	56 181 887	19.5704	7.2622
334	11 15 56	37 259 704	18.2757	6.9382	384	14 74 56	56 623 104	19.5959	7.2685
335	11 22 25	37 595 375	18.3030	6.9451	385	14 82 25	57 066 625	19.6214	7.2748
336	11 28 96	37 933 056	18.3303	6.9521	386	14 89 96	57 512 456	19.6469	7.2811
337	11 35 69	38 272 753	18.3576	6.9589	387	14 97 69	57 960 603	19.6723	7.2874
338	11 42 44	38 614 472	18.3848	6.9658	388	15 05 44	58 411 072	19.6977	7.2936
339	11 49 21	38 958 219	18.4120	6.9727	389	15 13 21	58 863 869	19.7231	7.2999
340	11 56 00	39 304 000	18.4391	6.9795	390	15 21 00	59 319 000	19.7484	7.3061
341	11 62 81	39 651 821	18.4662	6.9864	391	15 28 81	59 776 471	19.7737	7.3124
342	11 69 64	40 001 688	18.4932	6.9932	392	15 36 64	60 236 288	19.7990	7.3186
343	11 76 49	40 353 607	18.5203	7.0000	393	15 44 49	60 698 457	19.8242	7.3248
344	11 83 36	40 707 584	18.5472	7.0068	394	15 52 36	61 162 984	19.8494	7.3310
345	11 90 25	41 063 625	18.5742	7.0136	395	15 60 25	61 629 875	19.8746	7.3372
346	11 97 16	41 421 736	18.6011	7.0203	396	15 68 16	62 099 136	19.8997	7.3434
347	12 04 09	41 781 923	18.6279	7.0271	397	15 76 09	62 570 773	19.9249	7.3496
348	12 11 04	42 144 192	18.6548	7.0338	398	15 84 04	63 044 792	19.9499	7.3558
349	12 18 01	42 508 549	18.6815	7.0406	399	15 92 01	63 521 199	19.9750	7.3619
350	12 25 00	42 875 000	18 7083	7.0473	400	16 00 00	64 000 000	20.0000	7.3681

SQUARES, CUBES, SQUARE ROOTS & CUBE ROOTS.

(CONTINUED.)

Nos	Squares.	Cubes.	Square Root.	Cube Root	Nos	Squares.	Cubes.	Square Root.	Cube Root.
401	16 08 01	64 481 201	20.0250	7.3742	451	20 34 01	91 733 851	21.2368	7.6688
402	16 16 04	64 964 808	20.0499	7.3803	452	20 43 04	92 345 408	21.2603	7.6744
403	16 24 09	65 450 827	20.0749	7.3864	453	20 52 09	92 959 677	21.2838	7.6801
404	16 32 16	65 939 264	20.0998	7.3925	454	20 61 16	93 576 664	21.3073	7.6857
405	16 40 25	66 430 125	20.1246	7.3986	455	20 70 25	94 196 375	21.3307	7.6914
406	16 48 36	66 923 416	20.1494	7.4047	456	20 79 36	94 818 816	21.3542	7.6970
407	16 56 49	67 419 143	20.1742	7.4108	457	20 88 49	95 443 993	21.3776	7.7026
408	16 64 64	67 917 312	20.1990	7.4169	458	20 97 64	96 071 912	21.4009	7.7082
409	16 72 81	68 417 929	20.2237	7.4229	459	21 06 81	96 702 579	21.4243	7.7138
410	16 81 00	68 921 000	20.2485	7.4290	460	21 16 00	97 336 000	21.4476	7.7194
411	16 89 21	69 426 581	20.2731	7.4350	461	21 25 21	97 972 181	21.4709	7.7250
412	16 97 44	69 934 528	20.2978	7.4410	462	21 34 44	98 611 128	21.4942	7.7306
413	17 05 69	70 444 997	20.3224	7.4470	463	21 43 69	99 252 847	21.5174	7.7362
414	17 13 96	70 957 944	20.3470	7.4530	464	21 52 96	99 897 344	21.5407	7.7418
415	17 22 25	71 473 875	20.3715	7.4590	465	21 62 25	100 544 625	21.5639	7.7473
416	17 30 56	71 991 296	20.3961	7.4650	466	21 71 56	101 194 696	21.5870	7.7529
417	17 38 89	72 511 713	20.4206	7.4710	467	21 80 89	101 847 563	21.6102	7.7584
418	17 47 24	73 034 632	20.4450	7.4770	468	21 90 24	102 503 232	21.6333	7.7639
419	17 55 61	73 560 059	20.4695	7.4829	469	21 99 61	103 161 709	21.6564	7.7695
420	17 64 00	74 088 000	20.4939	7.4889	470	22 09 00	103 823 000	21.6795	7.7750
421	17 72 41	74 618 461	20.5183	7.4948	471	22 18 41	104 487 111	21.7025	7.7805
422	17 80 84	75 151 448	20.5426	7.5007	472	22 27 84	105 154 048	21.7256	7.7860
423	17 89 29	75 686 967	20.5670	7.5067	473	22 37 29	105 823 817	21.7486	7.7915
424	17 97 76	76 225 024	20.5913	7.5126	474	22 46 76	106 496 424	21.7715	7.7970
425	18 06 25	76 765 625	20.6155	7.5185	475	22 56 25	107 171 875	21.7945	7.8025
426	18 14 76	77 308 776	20.6398	7.5244	476	22 65 76	107 850 176	21.8174	7.8079
427	18 23 29	77 854 483	20.6640	7.5302	477	22 75 29	108 531 333	21.8403	7.8134
428	18 31 84	78 402 752	20.6882	7.5361	478	22 84 84	109 215 352	21.8632	7.8188
429	18 40 41	78 953 589	20.7123	7.5420	479	22 94 41	109 902 239	21.8861	7.8243
430	18 49 00	79 507 000	20.7364	7.5478	480	23 04 00	110 592 000	21.9089	7.8297
431	18 57 61	80 062 991	20.7605	7.5537	481	23 13 61	111 284 641	21.9317	7.8352
432	18 66 24	80 621 568	20.7846	7.5595	482	23 23 24	111 980 168	21.9545	7.8406
433	18 74 89	81 182 737	20.8087	7.5654	483	23 32 89	112 678 587	21.9773	7.8460
434	18 83 56	81 746 504	20.8327	7.5712	484	23 42 56	113 379 904	22.0000	7.8514
435	18 92 25	82 312 875	20.8567	7.5770	485	23 52 25	114 084 125	22.0227	7.8568
436	19 00 96	82 881 856	20.8806	7.5828	486	23 61 96	114 791 256	22.0454	7.8622
437	19 09 69	83 453 453	20.9045	7.5886	487	23 71 69	115 501 303	22.0681	7.8676
438	19 18 44	84 027 672	20.9284	7.5944	488	23 81 44	116 214 272	22.0907	7.8730
439	19 27 21	84 604 519	20.9523	7.6001	489	23 91 21	116 930 169	22.1133	7.8784
440	19 36 00	85 184 000	20.9762	7.6059	490	24 01 00	117 649 000	22.1359	7.8837
441	19 44 81	85 766 121	21.0000	7.6117	491	24 10 81	118 370 771	22.1585	7.8891
442	19 53 64	86 350 888	21.0238	7.6174	492	24 20 64	119 095 488	22.1811	7.8944
443	19 62 49	86 938 307	21.0476	7.6232	493	24 30 49	119 823 157	22.2036	7.8998
444	19 71 36	87 528 384	21.0713	7.6289	494	24 40 36	120 553 784	22.2261	7.9051
445	19 80 25	88 121 125	21.0950	7.6346	495	24 50 25	121 287 375	22.2486	7.9105
446	19 89 16	88 716 536	21.1187	7.6403	496	24 60 16	122 023 936	22.2711	7.9158
447	19 98 09	89 314 623	21.1424	7.6460	497	24 70 09	122 763 473	22.2935	7.9211
448	20 07 04	89 915 392	21.1660	7.6517	498	24 80 04	123 505 992	22.3159	7.9264
449	20 16 01	90 518 849	21.1896	7.6574	499	24 90 01	124 251 499	22.3383	7.9317
450	20 25 00	91 125 000	21.2132	7.6631	500	25 00 00	125 000 000	22.3607	7.9370

SQUARES, CUBES, SQUARE ROOTS & CUBE ROOTS.

(CONTINUED)

Nos	Squares.	Cubes.	Square Root.	Cube Root.	Nos	Squares.	Cubes.	Square Root.	Cube Root.
501	25 10 01	125 751 501	22.3830	7.9423	551	30 36 01	167 284 151	23.4784	8.1982
502	25 20 04	126 506 008	22.4054	7.9476	552	30 47 04	168 196 608	23.4947	8.2081
503	25 30 09	127 263 527	22.4277	7.9528	553	30 58 09	169 112 377	23.5160	8.2081
504	25 40 16	128 024 064	22.4499	7.9581	554	30 69 16	170 031 464	23.5372	8.2130
505	25 50 25	128 787 625	22.4722	7.9634	555	30 80 25	170 953 875	23.5584	8.2180
506	25 60 36	129 554 216	22.4944	7.9686	556	30 91 36	171 879 616	23.5797	8.2229
507	25 70 49	130 323 843	22.5167	7.9739	557	31 02 49	172 808 693	23.6008	8.2278
508	25 80 64	131 096 512	22.5389	7.9791	558	31 13 64	173 741 112	23.6220	8.2327
509	25 90 81	131 872 229	22.5610	7.9843	559	31 24 81	174 676 879	23.6432	8.2377
510	26 01 00	132 651 000	22.5832	7.9896	560	31 36 00	175 616 000	23.6643	8.2426
511	26 11 21	133 432 831	22.6053	7.9948	561	31 47 21	176 558 481	23.6854	8.2475
512	26 21 44	134 217 728	22.6274	8.0000	562	31 58 44	177 504 328	23.7065	8.2524
513	26 31 69	135 005 697	22.6495	8.0052	563	31 69 69	178 453 547	23.7276	8.2573
514	26 41 96	135 796 744	22.6716	8.0104	564	31 80 96	179 406 144	23.7487	8.2621
515	26 52 25	136 590 875	22.6936	8.0156	565	31 92 25	180 362 125	23.7697	8.2670
516	26 62 56	137 388 096	22.7156	8.0208	566	32 03 56	181 321 496	23.7908	8.2719
517	26 72 89	138 188 413	22.7376	8.0260	567	32 14 89	182 284 263	23.8118	8.2768
518	26 83 24	138 991 832	22.7596	8.0311	568	32 26 24	183 250 432	23.8328	8.2816
519	26 93 61	139 798 359	22.7816	8.0363	569	32 37 61	184 220 009	23.8537	8.2865
520	27 04 00	140 608 000	22.8035	8.0415	570	32 49 00	185 193 000	23.8747	8.2913
521	27 14 41	141 420 761	22.8254	8.0466	571	32 60 41	186 169 411	23.8956	8.2962
522	27 24 84	142 236 648	22.8473	8.0517	572	32 71 84	187 149 248	23.9165	8.3010
523	27 35 29	143 055 667	22.8692	8.0569	573	32 83 29	188 132 517	23.9374	8.3059
524	27 45 76	143 877 824	22.8910	8.0620	574	32 94 76	189 119 224	23.9583	8.3107
525	27 56 25	144 703 125	22.9129	8.0671	575	33 06 25	190 109 375	23.9792	8.3155
526	27 66 76	145 531 576	22.9347	8.0723	576	33 17 76	191 102 976	24.0000	8.3203
527	27 77 29	146 363 183	22.9565	8.0774	577	33 29 29	192 100 033	24.0208	8.3251
528	27 87 84	147 197 952	22.9783	8.0825	578	33 40 84	193 100 552	24.0416	8.3300
529	27 98 41	148 035 889	23.0000	8.0876	579	33 52 41	194 104 539	24.0624	8.3348
530	28 09 00	148 877 000	23.0217	8.0927	580	33 64 00	195 112 000	24.0832	8.3396
531	28 19 61	149 721 291	23.0434	8.0978	581	33 75 61	196 122 941	24.1039	8.3443
532	28 30 24	150 568 768	23.0651	8.1028	582	33 87 24	197 137 368	24.1247	8.3491
533	28 40 89	151 419 437	23.0868	8.1079	583	33 98 89	198 155 287	24.1454	8.3539
534	28 51 56	152 273 304	23.1084	8.1130	584	34 10 56	199 176 704	24.1661	8.3587
535	28 62 25	153 130 375	23.1301	8.1180	585	34 22 25	200 201 625	24.1868	8.3634
536	28 72 96	153 990 656	23.1517	8.1231	586	34 33 96	201 230 056	24.2074	8.3682
537	28 83 69	154 854 153	23.1733	8.1281	587	34 45 69	202 262 003	24.2281	8.3730
538	28 94 44	155 720 872	23.1948	8.1332	588	34 57 44	203 297 472	24.2487	8.3777
539	29 05 21	156 590 819	23.2164	8.1382	589	34 69 21	204 336 469	24.2693	8.3825
540	29 16 00	157 464 000	23.2379	8.1433	590	34 81 00	205 379 000	24.2899	8.3872
541	29 26 81	158 340 421	23.2594	8.1483	591	34 92 81	206 425 071	24.3105	8.3919
542	29 37 64	159 220 088	23.2809	8.1533	592	35 04 64	207 474 688	24.3311	8.3967
543	29 48 49	160 103 007	23.3024	8.1583	593	35 16 49	208 527 857	24.3516	8.4014
544	29 59 36	160 989 184	23.3238	8.1633	594	35 28 36	209 584 584	24.3721	8.4061
545	29 70 25	161 878 625	23.3452	8.1683	595	35 40 25	210 644 875	24.3926	8.4108
546	29 81 16	162 771 336	23.3666	8.1733	596	35 52 16	211 708 736	24.4131	8.4155
547	29 92 09	163 667 323	23.3880	8.1783	597	35 64 09	212 776 173	24.4336	8.4202
548	30 03 04	164 566 592	23.4094	8.1833	598	35 76 04	213 847 192	24.4540	8.4249
549	30 14 01	165 469 149	23.4307	8.1883	599	35 88 01	214 921 799	24.4745	8.4296
550	30 25 00	166 375 000	23.4521	8.1932	600	36 00 00	216 000 000	24.4949	8.4343

SQUARES, CUBES, SQUARE ROOTS & CUBE ROOTS

(CONTINUED.)

Nos	Squares.	Cubes.	Square Root.	Cube Root.	Nos	Squares.	Cubes.	Square Root.	Cube Root.
601	36 12 01	217 081 801	24.5153	8.4390	651	42 38 01	275 894 451	25.5147	8.6668
602	36 24 04	218 167 208	24.5357	8.4437	652	42 51 04	277 167 808	25.5343	8.6718
603	36 36 09	219 256 227	24.5561	8.4484	653	42 64 09	278 445 077	25.5539	8.6767
604	36 48 16	220 348 864	24.5764	8.4530	654	42 77 16	279 726 264	25.5734	8.6801
605	36 60 25	221 445 125	24.5967	8.4577	655	42 90 25	281 011 375	25.5930	8.6845
606	36 72 36	222 545 016	24.6171	8.4623	656	43 03 36	282 300 416	25.6125	8.6890
607	36 84 49	223 648 543	24.6374	8.4670	657	43 16 49	283 593 393	25.6320	8.6934
608	36 96 64	224 755 712	24.6577	8.4716	658	43 29 64	284 890 312	25.6515	8.6978
609	37 08 81	225 866 529	24.6779	8.4763	659	43 42 81	286 191 179	25.6710	8.7022
610	37 21 00	226 981 000	24.6982	8.4809	660	43 56 00	287 496 000	25.6905	8.7066
611	37 33 21	228 099 131	24.7184	8.4856	661	43 69 21	288 804 781	25.7099	8.7110
612	37 45 44	229 220 928	24.7386	8.4902	662	43 82 44	290 117 528	25.7294	8.7154
613	37 57 69	230 346 397	24.7588	8.4948	663	43 95 69	291 434 247	25.7488	8.7198
614	37 69 96	231 475 544	24.7790	8.4994	664	44 08 96	292 754 944	25.7682	8.7241
615	37 82 25	232 608 375	24.7992	8.5040	665	44 22 25	294 079 625	25.7876	8.7285
616	37 94 56	233 744 896	24.8193	8.5086	666	44 35 56	295 408 296	25.8070	8.7329
617	38 06 89	234 885 113	24.8395	8 5132	667	44 48 89	296 740 963	25.8263	8.7373
618	38 19 24	236 029 032	24.8596	8.5178	668	44 62 24	298 077 632	25.8457	8.7416
619	38 31 61	237 176 659	24.8797	8.5224	669	44 75 61	299 418 309	25.8650	8.7460
620	38 44 00	238 328 000	24.8998	8.5270	670	44 89 00	300 763 000	25.8844	8.7503
621	38 56 41	239 483 061	24.9199	8.5316	671	45 02 41	302 111 711	25.9037	8.7547
622	38 68 84	240 641 848	24.9399	8.5362	672	45 15 84	303 464 448	25.9230	8.7590
623	38 81 29	241 804 367	24.9600	8.5408	673	45 29 29	304 821 217	25.9422	8.7634
624	38 93 76	242 970 624	24.9800	8.5453	674	45 42 76	306 182 024	25.9615	8.7677
625	39 06 25	244 140 625	25.0000	8.5499	675	45 56 25	307 546 875	25.9808	8.7721
626	39 18 76	245 314 376	25.0200	8.5544	676	45 69 76	308 915 776	26.0000	8.7764
627	39 31 29	246 491 883	25.0400	8.5590	677	45 83 29	310 288 733	26.0192	8.7807
628	39 43 84	247 673 152	25.0599	8.5635	678	45 96 84	311 665 752	26.0384	8.7850
629	39 56 41	248 858 189	25.0799	8.5681	679	46 10 41	313 046 839	26.0576	8.7893
630	39 69 00	250 047 000	25.0998	8.5726	680	46 24 00	314 432 000	26.0768	8.7937
631	39 81 61	251 239 591	25.1197	8.5772	681	46 37 61	315 821 241	26.0960	8.7980
632	39 94 24	252 435 968	25.1396	8.5817	682	46 51 24	317 214 568	26.1151	8.8023
633	40 06 89	253 636 137	25.1595	8.5862	683	46 64 89	318 611 987	26.1343	8.8066
634	40 19 56	254 840 104	25.1794	8.5907	684	46 78 56	320 013 504	26.1534	8.8109
635	40 32 25	256 047 875	25.1992	8.5952	685	46 92 25	321 419 125	26.1725	8.8152
636	40 44 96	257 259 456	25.2190	8.5997	686	47 05 96	322 828 856	26 1916	8.8194
637	40 57 69	258 474 853	25.2389	8.6043	687	47 19 69	324 242 703	26.2107	8.8237
638	40 70 44	259 694 072	25.2587	8.6088	688	47 33 44	325 660 672	26.2298	8.8280
639	40 83 21	260 917 119	25.2784	8.6132	689	47 47 21	327 082 769	26.2488	8.8322
640	40 96 00	262 144 000	25.2982	8.6177	690	47 61 00	328 509 000	26.2679	8.8365
641	41 08 81	263 374 721	25.3180	8.6222	691	47 74 81	329 939 371	26.2869	8.8408
642	41 21 64	264 609 288	25.3377	8.6267	692	47 88 64	331 373 888	26.3059	8.8451
643	41 34 49	265 847 707	25.3574	8.6312	693	48 02 49	332 812 557	26.3249	8.8493
644	41 47 36	267 089 984	25.3772	8.6357	694	48 16 36	334 255 384	26.3439	8.8536
645	41 60 25	268 336 125	25.3969	8.6401	695	48 30 25	335 702 375	26.3629	8.8578
646	41 73 16	269 586 136	25.4165	8.6446	696	48 44 16	337 153 536	26.3818	8.8621
647	41 86 09	270 840 023	25.4362	8.6490	697	48 58 09	338 608 873	26.4008	8.8663
648	41 99 04	272 097 792	25.4558	8.6535	698	48 72 04	340 068 392	26.4197	8.8706
649	42 12 01	273 359 449	25.4755	8.6579	699	48 86 01	341 532 099	26.4386	8.8748
650	42 25 00	274 625 000	25.4951	8.6624	700	49 00 00	343 000 000	26.4575	8.8790

SQUARES, CUBES, SQUARE ROOTS & CUBE ROOTS
(CONTINUED.)

Nos	Squares.	Cubes.	Square Root.	Cube Root.	Nos	Squares.	Cubes.	Square Root.	Cube Root.
701	49 14 01	344 472 101	26.4764	8.8833	751	56 40 01	423 564 751	27.4044	9.0896
702	49 28 04	345 948 408	26.4958	8.8875	752	56 55 04	425 259 008	27.4226	9.0937
703	49 42 09	347 428 927	26.5141	8.8917	753	56 70 09	426 957 777	27.4408	9.0977
704	49 56 16	348 913 664	26.5330	8.8959	754	56 85 16	428 661 064	27.4591	9.1017
705	49 70 25	350 402 625	26.5518	8.9001	755	57 00 25	430 368 875	27.4773	9.1057
706	49 84 36	351 895 816	26.5707	8.9043	756	57 15 36	432 081 216	27.4955	9.1098
707	49 98 49	353 393 243	26.5895	8.9085	757	57 30 49	433 798 093	27.5136	9.1138
708	50 12 64	354 894 912	26.6083	8.9127	758	57 45 64	435 519 512	27.5318	9.1178
709	50 26 81	356 400 829	26.6271	8.9169	759	57 60 81	437 245 479	27.5500	9.1218
710	50 41 00	357 911 000	26.6458	8.9211	760	57 76 00	438 976 000	27.5681	9.1258
711	50 55 21	359 425 431	26.6646	8.9253	761	57 91 21	440 711 081	27.5862	9.1298
712	50 69 44	360 944 128	26.6833	8.9295	762	58 06 44	442 450 728	27.6043	9.1338
713	50 83 69	362 467 097	26.7021	8.9337	763	58 21 69	444 194 947	27.6225	9.1378
714	50 97 96	363 994 344	26.7208	8.9378	764	58 36 96	445 943 744	27.6405	9.1418
715	51 12 25	365 525 875	26.7395	8.9420	765	58 52 25	447 697 125	27.6586	9.1458
716	51 26 56	367 061 696	26.7582	8.9462	766	58 67 56	449 455 096	27.6767	9.1498
717	51 40 89	368 601 813	26.7769	8.9503	767	58 82 89	451 217 663	27.6948	9.1537
718	51 55 24	370 146 232	26.7955	8.9545	768	58 98 24	452 984 832	27.7128	9.1577
719	51 69 61	371 694 959	26.8142	8.9587	769	59 13 61	454 756 609	27.7308	9.1617
720	51 84 00	373 248 000	26.8328	8.9628	770	59 29 00	456 533 000	27.7489	9.1657
721	51 98 41	374 805 361	26.8514	8.9670	771	59 44 41	458 314 011	27.7669	9.1696
722	52 12 84	376 367 048	26.8701	8.9711	772	59 59 84	460 099 648	27.7849	9.1736
723	52 27 29	377 933 067	26.8887	8.9752	773	59 75 29	461 889 917	27.8029	9.1775
724	52 41 76	379 503 424	26.9072	8.9794	774	59 90 76	463 684 824	27.8209	9.1815
725	52 56 25	381 078 125	26.9258	8.9835	775	60 06 25	465 484 375	27.8388	9.1855
726	52 70 76	382 657 176	26.9444	8.9876	776	60 21 76	467 288 576	27.8568	9.1894
727	52 85 29	384 240 583	26.9629	8.9918	777	60 37 29	469 097 433	27.8747	9.1933
728	52 99 84	385 828 352	26.9815	8.9959	778	60 52 84	470 910 952	27.8927	9.1973
729	53 14 41	387 420 489	27.0000	9.0000	779	60 68 41	472 729 139	27.9106	9.2012
730	53 29 00	389 017 000	27.0185	9.0041	780	60 84 00	474 552 000	27.9285	9.2052
731	53 43 61	390 617 891	27.0370	9.0082	781	60 99 61	476 379 541	27.9464	9.2091
732	53 58 24	392 223 168	27.0555	9.0123	782	61 15 24	478 211 768	27.9643	9.2130
733	53 72 89	393 832 837	27.0740	9.0164	783	61 30 89	480 048 687	27.9821	9.2170
734	53 87 56	395 446 904	27.0924	9.0205	784	61 46 56	481 890 304	28.0000	9.2209
735	54 02 25	397 065 375	27.1109	9.0246	785	61 62 25	483 736 625	28.0179	9.2248
736	54 16 96	398 688 256	27.1293	9.0287	786	61 77 96	485 587 656	28.0357	9.2287
737	54 31 69	400 315 553	27.1477	9.0328	787	61 93 69	487 443 403	28.0535	9.2326
738	54 46 44	401 947 272	27.1662	9.0369	788	62 09 44	489 303 872	28.0713	9.2365
739	54 61 21	403 583 419	27.1846	9.0410	789	62 25 21	491 169 069	28.0891	9.2404
740	54 76 00	405 224 000	27.2029	9.0450	790	62 41 00	493 039 000	28.1069	9.2443
741	54 90 81	406 869 021	27.2213	9.0491	791	62 56 81	494 913 671	28.1247	9.2482
742	55 05 64	408 518 488	27.2397	9.0532	792	62 72 64	496 793 088	28.1425	9.2521
743	55 20 49	410 172 407	27.2580	9.0572	793	62 88 49	498 677 257	28.1603	9.2560
744	55 35 36	411 830 784	27.2764	9.0613	794	63 04 36	500 566 184	28.1780	9.2599
745	55 50 25	413 493 625	27.2947	9.0654	795	63 20 25	502 459 875	28.1957	9.2638
746	55 65 16	415 160 936	27.3130	9.0694	796	63 36 16	504 358 336	28.2135	9.2677
747	55 80 09	416 832 723	27.3313	9.0735	797	63 52 09	506 261 573	28.2312	9.2716
748	55 95 04	418 508 992	27.3496	9.0775	798	63 68 04	508 169 592	28.2489	9.2754
749	56 10 01	420 189 749	27.3679	9.0816	799	63 84 01	510 082 399	28.2666	9.2793
750	56 25 00	421 875 000	27.3861	9.0856	800	64 00 00	512 000 000	28.2843	9.2832

SQUARES, CUBES, SQUARE ROOTS & CUBE ROOTS
(CONTINUED.)

Nos	Squares.	Cubes.	Square Root.	Cube Root.	Nos	Squares.	Cubes.	Square Root.	Cube Root.
801	64 16 01	513 922 401	28.3019	9.2870	851	72 42 01	616 295 051	29.1719	9.4764
802	64 32 04	515 849 608	28.3196	9.2909	852	72 59 04	618 470 208	29.1890	9.4801
803	64 48 09	517 781 627	28.3373	9.2948	853	72 76 09	620 650 477	29.2062	9.4838
804	64 64 16	519 718 464	28.3549	9.2986	854	72 93 16	622 835 864	29.2233	9.4875
805	64 80 25	521 660 125	28.3725	9.3025	855	73 10 25	625 026 375	29.2404	9.4912
806	64 96 36	523 606 616	28.3901	9.3063	856	73 27 36	627 223 016	29.2575	9.4949
807	65 12 49	525 557 943	28.4077	9.3102	857	73 44 49	629 422 793	29.2746	9.4986
808	65 28 64	527 514 112	28.4253	9.3140	858	73 61 64	631 628 712	29.2916	9.5023
809	65 44 81	529 475 129	28.4429	9.3179	859	73 78 81	633 839 779	29.3087	9.5060
810	65 61 00	531 441 000	28.4605	9.3217	860	73 96 00	636 056 000	29.3258	9.5097
811	65 77 21	533 411 731	28.4781	9.3255	861	74 13 21	638 277 381	29.3428	9.5134
812	65 93 44	535 387 328	28.4956	9.3294	862	74 30 44	640 503 928	29.3598	9.5171
813	66 09 69	537 367 797	28.5132	9.3332	863	74 47 69	642 735 647	29.3769	9.5207
814	66 25 96	539 353 144	28.5307	9.3370	864	74 64 96	644 972 544	29.3939	9.5244
815	66 42 25	541 343 375	28.5482	9.3408	865	74 82 25	647 214 625	29.4109	9.5281
816	66 58 56	543 338 496	28.5657	9.3447	866	74 99 56	649 461 896	29.4279	9.5317
817	66 74 89	545 338 513	28.5832	9.3485	867	75 16 89	651 714 363	29.4449	9.5354
818	66 91 24	547 343 432	28.6007	9.3523	868	75 34 24	653 972 032	29.4618	9.5391
819	67 07 61	549 353 259	28.6182	9.3561	869	75 51 61	656 234 909	29.4788	9.5427
820	67 24 00	551 368 000	28.6356	9.3599	870	75 69 00	658 503 000	29.4958	9.5464
821	67 40 41	553 387 661	28.6531	9.3637	871	75 86 41	660 776 311	29.5127	9.5501
822	67 56 84	555 412 248	28.6705	9.3675	872	76 03 84	663 054 848	29.5296	9.5537
823	67 73 29	557 441 767	28.6880	9.3713	873	76 21 29	665 338 617	29.5466	9.5574
824	67 89 76	559 476 224	28.7054	9.3751	874	76 38 76	667 627 624	29.5635	9.5610
825	68 06 25	561 515 625	28.7228	9.3789	875	76 56 25	669 921 875	29.5804	9.5647
826	68 22 76	563 559 976	28.7402	9.3827	876	76 73 76	672 221 376	29.5973	9.5683
827	68 39 29	565 609 283	28.7576	9.3865	877	76 91 29	674 526 133	29.6142	9.5719
828	68 55 84	567 663 552	28.7750	9.3902	878	77 08 84	676 836 152	29.6311	9.5756
829	68 72 41	569 722 789	28.7924	9.3940	879	77 26 41	679 151 439	29.6479	9.5792
830	68 89 00	571 787 000	28.8097	9.3978	880	77 44 00	681 472 000	29.6648	9.5828
831	69 05 61	573 856 191	28.8271	9.4016	881	77 61 61	683 797 841	29.6816	9.5865
832	69 22 24	575 930 368	28.8444	9.4053	882	77 79 24	686 128 968	29.6985	9.5901
833	69 38 89	578 009 537	28.8617	9.4091	883	77 96 89	688 465 387	29.7153	9.5937
834	69 55 56	580 093 704	28.8791	9.4129	884	78 14 56	690 807 104	29.7321	9.5973
835	69 72 25	582 182 875	28.8964	9.4166	885	78 32 25	693 154 125	29.7489	9.6010
836	69 88 96	584 277 056	28.9137	9.4204	886	78 49 96	695 506 456	29.7658	9.6046
837	70 05 69	586 376 253	28.9310	9.4241	887	78 67 69	697 864 103	29.7825	9.6082
838	70 22 44	588 480 472	28.9482	9.4279	888	78 85 44	700 227 072	29.7993	9.6118
839	70 39 21	590 589 719	28.9655	9.4316	889	79 03 21	702 595 369	29.8161	9.6154
840	70 56 00	592 704 000	28.9828	9.4354	890	79 21 00	704 969 000	29.8329	9.6190
841	70 72 81	594 823 321	29.0000	9.4391	891	79 38 81	707 347 971	29.8496	9.6226
842	70 89 64	596 947 688	29.0172	9.4429	892	79 56 64	709 732 288	29.8664	9.6262
843	71 06 49	599 077 107	29.0345	9.4466	893	79 74 49	712 121 957	29.8831	9.6298
844	71 23 36	601 211 584	29.0517	9.4503	894	79 92 36	714 516 984	29.8998	9.6334
845	71 40 25	603 351 125	29.0689	9.4541	895	80 10 25	716 917 375	29.9166	9.6370
846	71 57 16	605 495 736	29.0861	9.4578	896	80 28 16	719 323 136	29.9333	9.6406
847	71 74 09	607 645 423	29.1033	9.4615	897	80 46 09	721 734 273	29.9500	9.6442
848	71 91 04	609 800 192	29.1204	9.4652	898	80 64 04	724 150 792	29.9666	9.6477
849	72 08 01	611 960 049	29.1376	9.4690	899	80 82 01	726 572 699	29.9833	9.6513
850	72 25 00	614 125 000	29.1548	9.4727	900	81 00 00	729 000 000	30.0000	9.6549

SQUARES, CUBES, SQUARE ROOTS & CUBE ROOTS.

(CONTINUED.)

Nos	Squares.	Cubes.	Square Root.	Cube Root.	Nos.	Squares.	Cubes.	Square Root.	Cube Root.
901	81 18 01	731 432 701	30.0167	9.6585	951	90 44 01	860 085 351	30.8388	9.8389
902	81 36 04	733 870 808	30.0333	9.6620	952	90 63 04	862 801 408	30.8545	9.8874
903	81 54 09	736 314 327	30.0500	9.6656	953	90 82 09	865 523 177	30.8707	9.8408
904	81 72 16	738 763 264	30.0666	9.6692	954	91 01 16	868 250 664	30.8869	9.8443
905	81 90 25	741 217 625	30.0832	9.6727	955	91 20 25	870 983 875	30.9031	9.8477
906	82 08 36	743 677 416	30.0998	9.6763	956	91 39 36	873 722 816	30.9192	9.8511
907	82 26 49	746 142 643	30.1164	9.6799	957	91 58 49	876 467 493	30.9354	9.8546
908	82 44 64	748 613 312	30.1330	9.6834	958	91 77 64	879 217 912	30.9516	9.8580
909	82 62 81	751 089 429	30.1496	9.6870	959	91 96 81	881 974 079	30.9677	9.8614
910	82 81 00	753 571 000	30.1662	9.6905	960	92 16 00	884 736 000	30.9839	9.8648
911	82 99 21	756 058 031	30.1828	9.6941	961	92 35 21	887 503 681	31.0000	9.8683
912	83 17 44	758 550 528	30.1993	9.6976	962	92 54 44	890 277 128	31.0161	9.8717
913	83 35 69	761 048 497	30.2159	9.7012	963	92 73 69	893 056 347	31.0322	9.8751
914	83 53 96	763 551 944	30.2324	9.7047	964	92 92 96	895 841 344	31.0483	9.8785
915	83 72 25	766 060 875	30.2490	9.7082	965	93 12 25	898 632 125	31.0644	9.8819
916	83 90 56	768 575 296	30.2655	9.7118	966	93 31 56	901 428 696	31.0805	9.8854
917	84 08 89	771 095 213	30.2820	9.7153	967	93 50 89	904 231 063	31.0966	9.8888
918	84 27 24	773 620 632	30.2985	9.7188	968	93 70 24	907 039 232	31.1127	9.8922
919	84 45 61	776 151 559	30.3150	9.7224	969	93 89 61	909 853 209	31.1288	9.8956
920	84 64 00	778 688 000	30.3315	9.7259	970	94 09 00	912 673 000	31.1448	9.8990
921	84 82 41	781 229 961	30.3480	9.7294	971	94 28 41	915 498 611	31.1609	9.9024
922	85 00 84	783 777 448	30.3645	9.7329	972	94 47 84	918 330 048	31.1769	9.9058
923	85 19 29	786 330 467	30.3809	9.7364	973	94 67 29	921 167 317	31.1929	9.9092
924	85 37 76	788 889 024	30.3974	9.7400	974	94 86 76	924 010 424	31.2090	9.9126
925	85 56 25	791 453 125	30.4138	9.7435	975	95 06 25	926 859 375	31.2250	9.9160
926	85 74 76	794 022 776	30.4302	9.7470	976	95 25 76	929 714 176	31.2410	9.9194
927	85 93 29	796 597 983	30.4467	9.7505	977	95 45 29	932 574 833	31.2570	9.9227
928	86 11 84	799 178 752	30.4631	9.7540	978	95 64 84	935 441 352	31.2730	9.9261
929	86 30 41	801 765 089	30.4795	9.7575	979	95 84 41	938 313 739	31.2890	9.9295
930	86 49 00	804 357 000	30.4959	9.7610	980	96 04 00	941 192 000	31.3050	9.9329
931	86 67 61	806 954 491	30.5123	9.7645	981	96 23 61	944 076 141	31.3209	9.9363
932	86 86 24	809 557 568	30.5287	9.7680	982	96 43 24	946 966 168	31.3369	9.9396
933	87 04 89	812 166 237	30.5450	9.7715	983	96 62 89	949 862 087	31.3528	9.9430
934	87 23 56	814 780 504	30.5614	9.7750	984	96 82 56	952 763 904	31.3688	9.9464
935	87 42 25	817 400 375	30.5778	9.7785	985	97 02 25	955 671 625	31.3847	9.9497
936	87 60 96	820 025 856	30.5941	9.7819	986	97 21 96	958 585 256	31.4006	9.9531
937	87 79 69	822 656 953	30.6105	9.7854	987	97 41 69	961 504 803	31.4166	9.9565
938	87 98 44	825 293 672	30.6268	9.7889	988	97 61 44	964 430 272	31.4325	9.9598
939	88 17 21	827 936 019	30.6431	9.7924	989	97 81 21	967 361 669	31.4484	9 9632
940	88 36 00	830 584 000	30.6594	9.7959	990	98 01 00	970 299 000	31.4643	9.9666
941	88 54 81	833 237 621	30.6757	9.7993	991	98 20 81	973 242 271	31.4802	9.9699
942	88 73 64	835 896 888	30.6920	9.8028	992	98 40 64	976 191 488	31.4960	9.9733
943	88 92 49	838 561 807	30.7083	9.8063	993	98 60 49	979 146 657	31.5119	9.9766
944	89 11 36	841 232 384	30.7246	9.8097	994	98 80 36	982 107 784	31.5278	9.9800
945	89 30 25	843 908 625	30.7409	9.8133	995	99 00 25	985 074 875	31.5436	9.9833
946	89 49 16	846 590 536	30.7571	9.8167	996	99 20 16	988 047 936	31.5595	9.9866
947	89 68 09	849 278 123	30.7734	9.8201	997	99 40 09	991 026 973	31.5753	9.9900
948	89 87 04	851 971 392	30.7896	9.8236	998	99 60 04	994 011 992	31.5911	9.9933
949	90 06 01	854 670 349	30.8058	9.8270	999	99 80 01	997 002 999	31.6070	9.9967
950	90 25 00	857 375 000	30.8221	9.8305	1000	1 00 00 00	1 000 000 000	31.6228	10.0000

PATENT COLD ROLLED STEEL SHAFTING, PISTON RODS, ETC.

Made to Whitworth's Standard Gauge, and accurately straightened.

ROUND.				SQUARE.	
Diam.	Weight per foot.	Diam.	Weight per foot.	Size.	Weight per foot.
5 in.	67.45	1⅞ in.	7.06	4 in.	54.42
4 15/16	65.50	1 9/16	6.52	3 15/16	47.84
4⅞	60.88	1½	6.01	3⅞	41.67
4 13/16	54.11	1 7/16	5.60	3 13/16	35.92
4 7/16	52.62	1 7/16	5.52	3	30.61
4¼	48.26	1 13/16	5.26	2 13/16	25.72
4	42.75	1⅝	5.05	2¾	21.26
3 15/16	41.04	1 5/16	4.61	2 11/16	17.25
3⅞	39.40	1½	4.17	2	13.60
3 13/16	37.57	1 3/16	3.86	1 13/16	10.41
3 11/16	36.40	1 9/16	3.77	1⅝	8.98
3⅝	35.20	1 1/16	3.38	1 5/16	7.66
3 13/16	32.73	1 13/16	3.20	1 3/16	6.43
3 7/16	31.58	1 5/16	3.11	1 1/16	5.31
3⅜	30.43	1 1/16	3.02	1	4.30
3 5/16	28.22	1	2.68	15/16	3.85
3 3/16	27.16	31/32	2.52	⅞	3.40
3 1/16	26.09	29/32	2.35	13/16	2.99
3	24.05	27/32	2.20	3/4	2.60
2 15/16	23.06	25/32	2.05	11/16	2.25
2 13/16	22.09	23/32	1.94	5/8	1.92
2 11/16	21.15	21/32	1.90	9/16	1.61
2⅝	20.21	19/32	1.77	½	1.34
2 9/16	19.31	17/32	1.50	7/16	1.08
2 5/16	18.41	15/32	1.38	3/8	.850
2 9/16	17.55	13/32	1.26	5/16	.652
2 7/16	16.70	11/32	1.17	¼	.479
2 7/16	15.89	9/32	1.05	3/16	.332
2⅜	15.07	7/32	1.00	5/32	.270
2 5/16	14.35	9/16	.845	1/4	.213
2 3/16	13.52	5/32	.667		
2 3/16	12.80	1/8	.586		
2 1/16	12.07	7/16	.511		
2 1/16	11.35	3/32	.450		
2	10.69	1/16	.375		
1 15/16	10.03	1/32	.320		
1 15/16	9.39	5/16	.260		
1 13/16	8.78	1/4	.167		
1 13/16	8.18	3/32	.130		
1 11/16	7.61	1/16	.095		

The shafts are kept on hand at the mill, in lengths of 24 feet, and are cut to any length desired.

SEND FOR OUR SHAFTING CATALOGUE.

COLD-DRAWN STEEL HEXAGONS.

SPECIAL STEEL FOR SCREWS.

Size.	Lbs. per foot.	Size.	Lbs. per foot.	Size.	Lbs. per foot.	Size.	Lbs. per foot.
1/4	.195	9/16	.98	7/8	2.25	1 3/16	4.15
5/16	.37	5/8	1.15	15/16	2.58	1 1/4	4.60
3/8	.53	11/16	1.40	1	2.94	1 5/16	5.07
7/16	.56	3/4	1.66	1 1/16	3.33	1 3/8	5.57
1/2	.73	13/16	1.91	1 1/8	3.73	1 7/8	10.32

PATENT COLD-ROLLED STEEL FLATS.

FOR KEYS, ENGINE GUIDES, ELEVATOR SLIDES, ETC.

5/16	to 2	x 1/4	and 5/16	1 9/16	to 3	x 1 1/2	to 1 11/16
5/16	to 2	x 3/8	and 5/16	1 11/16	to 3	x 1 3/4	to 1 15/16
9/16	to 3	x 1/4	and 9/16	2 1/16	to 3	x 2	to 2 3/16
9/16	to 3	x 3/8	and 11/16	2 5/16	to 3	x 2 1/4	to 2 7/16
1 3/16	to 3	x 3/4	to 1 3/16	2 9/16	to 3	x 2 1/2	to 2 11/16
1 1/16	to 3	x 1	to 1 7/16	2 13/16	to 3	x 2 3/4	to 2 15/16

We are already prepared to furnish many sizes of Cold-Rolled Steel Flats, and will provide grooves for making other sizes whenever the quantities wanted are large enough to warrant us in incurring the necessary expense.

PATENT COLD-ROLLED STEEL FINGER BARS, KNIFE BACKS, Z BARS AND ANGLE BARS

FOR MOWERS, REAPERS AND HARVESTERS.

Bicycle manufacturers will find our Cold-Rolled Steel especially adapted to their work.

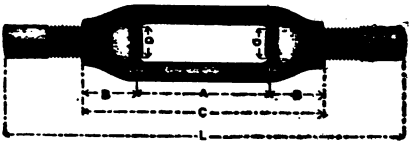
Prices will be given on application.

Estimates made promptly for producing new shapes or special sections.

NOTE.—On sizes 2½" square and larger, the corners are slightly rounded. All sizes below 2½" sharp corners.

All sizes are *accurately* rolled.

TURNBUCKLES.



D. Size=Diameter of Screw.
A. Length in Clear between Heads.
B. Length of Tapped Heads=1½ D.
C. Total Length of Buckle.
L. Total Length of Buckle and Stub Ends, when open.

Size D.	A	B	C	L	Size D.	A	B	C	L
⅜	6	9/16	7⅛	22	1⅛	6	2⅝	11¼	28
7/16	6	21/32	7 5/16	22	1⅞	6	2 13/16	11⅝	29
½	6	¾	7¼	22	2	6	3	12	29
9/16	6	27/32	7 11/16	22	2⅛	6	3 3/16	12⅜	29
⅝	6	15/16	7⅞	22	2¼	6	3⅜	12¾	30
¾	6	1⅛	8¼	23	2⅜	6	3 9/16	13⅛	31
⅞	6	1 5/16	8⅝	24	2½	6	3¾	13½	32
1	6	1½	9	25	2⅝	6	3 15/16	13⅞	32
1⅛	6	1 11/16	9⅜	25	2¾	6	4⅛	14¼	33
1¼	6	1⅞	9¾	26	2⅞	6	4 5/16	14⅝	33
1⅜	6	2 1/16	10⅛	27	3	6	4½	15	34
1½	6	2¼	10½	27	3¼	6	4⅞	15¾	36
1⅝	6	2 7/16	10⅞	28	3½	6	5¼	16½	37

Lengths given above are Standard for Bridge, Roof and ordinary Truss Buckles.

They have a guaranteed strength of 60,000 pounds per square inch of section of bolt at bottom of thread. Stub bolt ends are made of good bridge iron having tensile strength of 50,000 pounds per square inch.

Open Buckles of this form can be adjusted with a bar, hook, or wrench, and have the great advantage of showing the ends of the bolts, so that inspectors can see that they have a good hold of thread, and do not butt together.

MENSURATION.

$\pi = 3.1415926536$

$\frac{\pi}{2} = 1.5708$

$\frac{\pi}{3} = 1.0472$

$\frac{\pi}{4} = 0.7854$

$\frac{\pi}{12} = 0.2618$

$\frac{\pi}{64} = 0.04909$

$\frac{1}{\pi} = 0.31831$

$\frac{1}{\pi^2} = 0.10132$

$\pi^2 = 9.86960$

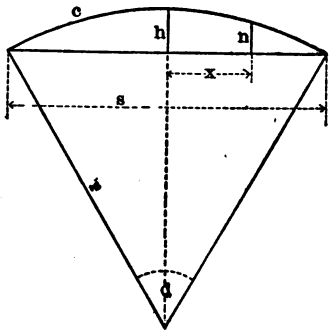
$\pi^3 = 31.00628$

log. $\pi = 0.4971499$

$\sqrt{\pi} = 1.77245$

$\sqrt{\frac{1}{\pi}} = 0.56419$

log. $\sqrt{\pi} = 0.2485749$



$$r = \frac{h^2 + \frac{s^2}{4}}{2h}$$

or very nearly $= \frac{s^2}{8h}$

$$n = \sqrt{r^2 - x^2} - (r - h)$$

$$h = r - \sqrt{r^2 - \frac{s^2}{4}}$$

or very nearly $= \frac{s^2}{8r}$

$c = a\ 2\ r\ 0{,}008727$

CIRCLE.

A = area. r = radius.
d = diameter. V = contents.

$$A = \frac{\pi \times d^2}{4} = 0.7854\, d^2 \qquad d = 1{,}12838\ \sqrt{A}$$

SECTOR.

$$A = \frac{a}{360}\, \pi\, r^2$$

SEGMENT.

$$A = \left(\frac{a}{180}\pi - \text{sin. } a \right) \frac{r^2}{2}$$

or approximately

$$\frac{h}{65}\,(3\,h^2 + 4\,s^2)$$

For flat segments very nearly $A = \frac{2}{3}\, s\, h$

MENSURATION—CONTINUED.

TRIANGLE.

$A = \sqrt{s \times (s-a)\,(s-b)\,(s-c)}$

if s half of the sum of the sides a, b, and c

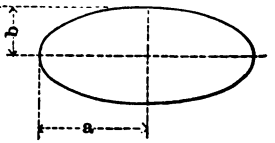
or = base × half perpendicular height.

POLYGONS.

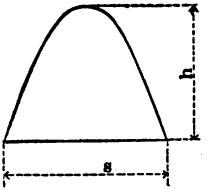
Area of any irregular polygon can be found by dividing the polygon into triangles and take the sum of the triangles' area. Area of any regular polygon

$$= \frac{\text{No. of sides}}{2} \times (\text{circumscribed rad.})^2 \times \sin. \frac{2\pi}{\text{No. sides.}}$$

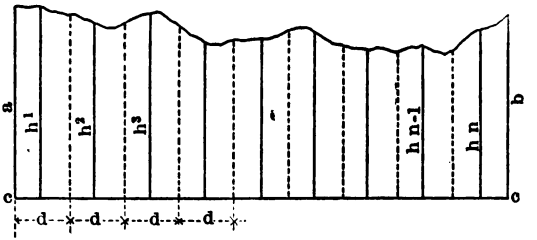
ELLIPSE.—$A = \pi\, a\, b$



PARABOLA.—$A = \frac{2}{3}\, s\, h$



AREA OF ANY IRREGULAR PLANE SURFACE.



Divide the surface into any number, say n, parallel strips of equal widths, d, whose middle ordinates are represented by $h_1\ h_2\ h_3\ h_4 \ldots\ldots\ldots\ldots h_{n-1}\ h_n$

then is, after Poncelet's rule,

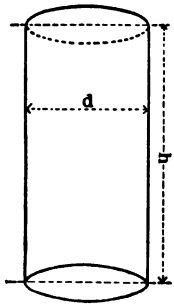
$$A = d\,\Sigma\,h + \tfrac{1}{12}\,d\,(a - h_1) + \tfrac{1}{12}\,d\,(b - h_n)$$

but more exact after Francke's rule,

$$A = d\,\Sigma\,h + \tfrac{1}{12}\,d\,(8\,a + h_2 - 9\,h_1) + \tfrac{1}{12}\,d\,(8\,b + h_{n-1} - 9\,h_n)$$

MENSURATION—CONTINUED.

CYLINDER.



$$A = \pi d h + \left(\frac{\pi d^2}{4}\right) 2$$

$$V = \frac{\pi d^2}{4} h$$

SPHERE.

$$A = \pi d^2 \qquad V = \frac{\pi d^3}{6}$$

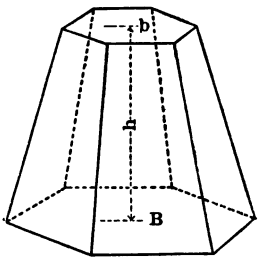
PYRAMID AND CONE.

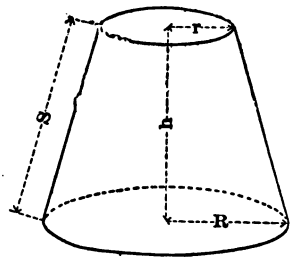
A = periphery or circumference of base × half slant height.
V = area of base + ⅓ perpendicular height.

FRUSTUM.

A = sum of peripheries or circumferences of the two ends × half slant height + area of both ends.

Frustum of a cone. $V = \frac{1}{3} \pi h (R^2 + r^2 + Rr)$





Frustum of pyramid. $V = \frac{1}{3} h (B + \sqrt{Bb} + b)$
(h being the distance of the two parallel end surfaces B and b).

MENSURATION—CONTINUED.

PROPERTIES OF THE CIRCLE.

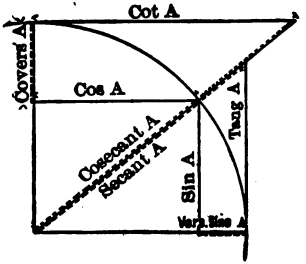
Circumference = Diam. × 3.1416 or 3¼.
Diam. × .8862 = Side of an equal square.
Diam. × .7071 = " " inscribed "
Diam.^{2} × 7854 = Area of circle.
Radius × 6.2832 = Circumference.
Circumference = 3.5446 $\sqrt{\text{area of circle.}}$
Diam. = 1.1283 $\sqrt{\text{area of circle.}}$
Length of arc = No. of degrees × .017453 radius.
Degrees in arc whose length equals radius = 57° 2958.
Length of an arc of 1° = Radius × .017453.
" " " 1′ = Radius × .0002909.
" " " 1″ = Radius × .0000048.
π = Proportion of circumference to diameter = 3.1415926.
π^2 = 9.8696044.
$\sqrt{\pi}$ = 1.7724538.
Log. π = 0.4971499.
$\frac{1}{\pi}$ = 0.3183001.
$\frac{1}{360}$ = .002778.
$\frac{360}{\pi}$ = 114.59

TRIGONOMETRICAL FORMULÆ.

GENERAL EQUIVALENTS.

The diagram shows the different trigonometrical expressions in terms of the angle A.

In the following formulæ Radius = 1.



MENSURATION—CONTINUED.

Complement of an angle = its difference from 90°

Supplement of an angle = its difference from 180°

$$\text{Sin.} = \frac{1}{\text{cosec.}} = \frac{\text{cos.}}{\text{cot.}} = \sqrt{(1-\text{cos.}^2)}$$

$$\text{Tan.} = \frac{\text{sin.}}{\text{cos.}} = \frac{1}{\text{cot.}}$$

$$\text{Sec.} = \sqrt{\text{Rad.}^2+\text{tan.}^2} = \frac{1}{\text{cos.}} = \frac{\text{tan.}}{\text{sin.}}$$

$$\text{Cos.} = \sqrt{(1-\text{sin.}^2)} = \frac{\text{sin.}}{\text{tan.}} = \text{sin.} \times \text{cot.} = \frac{1}{\text{sec.}}$$

$$\text{Cot.} = \frac{\text{cos.}}{\text{sin.}} = \frac{1}{\text{tan.}} \qquad \text{Cosec.} = \frac{1}{\text{sin.}}$$

Versin. = Rad. — cos Coversin. = Rad. — Sin.

$$\text{Rad.} = \text{tan.} \times \text{cot.} = \sqrt{\text{sin.}^2+\text{cos.}^2}$$

SOLUTION OF RIGHT-ANGLED TRIANGLES.

Hypoth.^{2} = base^2 + perpend.^{2}

Base^2 = (hyp. + perp.) × (hyp. — perp).

Perp.^{2} = (hyp. + base) × (hyp. — base).

$$\text{Sin.} = a\,\frac{A}{C} \qquad \text{Cot.}\ a = \frac{B}{A}$$

$$\text{Cos.}\ a = \frac{B}{C} \qquad \text{Cos.}\ b = \frac{A}{C}$$

$$\text{Tan.}\ a = \frac{A}{B} \qquad \text{Cot.}\ b = \frac{A}{B}$$

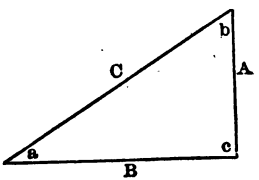
$$\text{Cosec.}\ a = \frac{C}{A} \qquad b = 90° - a$$

$$\text{Sec.}\ a = \frac{C}{B} \qquad A = B \text{ tan. } a$$

$$A = C \text{ sin. } a$$

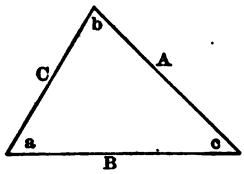
$$B = C \text{ cos. } a = A \text{ cot. } a = \sqrt{(C+A)(C-A)}$$

$$C = \sqrt{A^2+B^2} = \frac{A}{\text{sin. } a} = \frac{B}{\text{cos. } a}$$



MENSURATION—CONTINUED.

SOLUTION OF OBLIQUE-ANGLED TRIANGLES.



Value of any side C is:

$$C = \frac{A \text{ sin. } c}{\text{sin. } a} = \frac{B \text{ sin. } c}{\text{sin. } b} = \frac{A}{\text{cos. } b + \text{sin. } b \text{ cot. } c}$$

$$C = \frac{B}{\text{cos. } a + \text{sin. } a \text{ cot. } c} = A \text{ cos. } b + A$$

$$C = \sqrt{A^2 + B^2 - 2A\,B \text{ cos. } c} =$$

$$B \text{ cos. } a + B \text{ sin. } a \text{ cot. } b$$

Value of any angle a is:

$$\text{Sin. } a = \frac{A \text{ sin. } c}{c} = \frac{A \text{ sin. } b}{B} = \text{sin. } (b + c)$$

$$\text{Sin. } a = \text{sin. } b \text{ cos. } c + \text{cos. } b \text{ sin. } c$$

$$\text{Cos. a} = \text{sin. } b \text{ sin. } c - \text{cos. } b \text{ Cos. } c$$

$$\text{Cos. } a = \frac{C^2 + B^2 - A^2}{2\,B\,C}$$

$$\text{Tan. } a = \frac{A \text{ sin. } c}{B - A \text{ cos. } c} = \frac{A \text{ sin. } b}{C - A \text{ cos. } b}$$

$$\text{Tan. } a = \frac{\text{tan. } b + \text{tan. } c}{\text{tan. } b \text{ n.c at.} - 1}$$

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